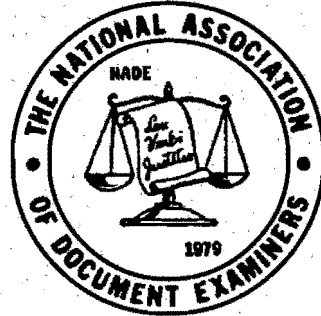


Journal of The National Association of Document Examiners

Summer 1999
Volume 22, No. 2



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Plus: Forensically Speaking

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Editorial

The number three and the concept of the triad have been significant in philosophy, mathematics, psychology, religion and other spheres of human endeavor. Consider philosophy and the Hegelian Dialectic of thesis, antithesis, synthesis. In mathematics, there is Euclidean geometry in which three points determine a plane. Freudian psychology defines the ego, id and superego. And in Christianity there is the Holy Trinity.

What does this have to do with Document Examination? There seem to be three threads of important information in our field. One is the understanding of handwriting - how it is produced and what characteristics are significant for identification. Most examiners I know, at least those in the private sector, agree that cases involving handwriting comprise the bulk of their work load.

The second thread of information involves the examination of other document factors beyond handwriting - knowledge of ink, paper, office machinery, erasures, other alterations, and more. This is a rapidly expanding area of study with new equipment constantly becoming available for both use and abuse. Keeping up is a challenge.

The third thread relates to communication of our opinions, usually within the legal system: writing reports, court testimony, presentation of evidence, and professional interaction.

Each of these three areas is an essential leg of the tripod of knowledge we require as document examiners. And in each issue of this Journal we try to publish a range of articles that tap into all three areas. In this issue you will find articles covering Rhythm in Handwriting, Thin Layer Chromatography, a recent Supreme Court decision, and other topics which fit into the three categories discussed here.

There are two new feature in this issue. For the first time we are publishing illustrations in color. We do this because color is the deciding factor in some cases and/or the use of color is essential in demonstrating some opinions. Technology is making it easier and more affordable to use color in exhibits, and in the Journal. This addition of occasional color content broadens the scope of information that can be conveyed in the Journal.

With this issue we are introducing a new section entitled Case Notes. As you will read in this issue, Case Notes are brief summaries of cases which illustrate a particular philosophy, technique or nugget of information that you would like to share with your colleagues. We welcome contributions of your own Case Notes for this new section.

Emily Will
Chief Editor

THIN LAYER CHROMATOGRAPHY

by

Don Lacy, CDE, Emily Will, CDE, and
Armand-Didier Cadol, CDE

ABSTRACT: Differentiation between inks can sometimes be accomplished with a chemical process called Thin Layer Chromatography (TLC). "Thin Layer" refers to the dissolution of ink with a solvent to form a thin solution which can flow easily during the second part of the process. "Chromatography" refers to the separation of materials which form distinct bands and colors. A simple analysis of inks can be done as a part of a document examination with fairly inexpensive materials and within a reasonable length of time. One of the authors is quite experienced with this technique and has written a procedural outline to guide others through the process. The other authors had never done TLC before, although they were acquainted with the process and results, so they launched themselves into the testing of the set guidelines by closely following them, and added comments in this presentation for first time users.

What is TLC?

At the 1998 NADE conference in New Orleans, Mr. Don Lacy explained and demonstrated a simple method of discriminating among inks by using TLC. Under his subsequent guidance, the other two authors, enthused by the process and seeing a very probable future need for this type of testing during the course of their own questioned document work, experimented with the process and obtained excellent results. Chromatography is a method of separating the substances that make up a compound. This separation is achieved by passing the compound through an adsorbent¹ material. Except in the case of gases, the compound is placed in solution before

being exposed to the adsorbent material. The adsorbent material attracts the substances in the compound to different extents, causing them to separate from one another². Thin Layer Chromatography uses a thin layer of adsorbent material on a flat plate made of glass, metal, or plastic. A sample of the compound being studied is applied near one edge of the plate. This edge is brought into contact with the eluent³, which moves upward through the adsorbent material. The substances in the compound separate on the plate⁴. A number of techniques exist to determine the kind of ink that was used to produce writing⁵. Since the 1950s the most common chemical ink testing is chromatography, especially thin-layer chromatography⁶.

Materials needed to perform TLC:

Laboratory equipment generally recommended:

- 1 100 ml graduate beaker (to mix solutions)
- 4-6 (or more) glass vials, or test tubes - 1 ml each (for extracting dyes of each ink to be tested)
- 6 or more capillary glass tubes (for transferring small quantities of solvent)
- 1 small, tightly covered test jar - approximately 2 inches wide by 4 inches high
- 1 small, tightly covered amber jar to store a small amount of mixed chemicals
- TLC plates
- a clean safety razor blade to scrape samples of the questioned ink.

Laboratory equipment recommended by some of the authors:

- Tweezers, or hemostat, or metal alligator clamps
- 30-gauge needles extra fine, and syringes (used to dispense insulin)
- 16-gauge needles and syringes to fit that particular size of needles
- Latex gloves
- Jeweler's glasses
- Several thin electrical copper wires stripped of

their plastic sheathes

1 (preferably white) contact lens case

1 jar tightly sealed with DMF solution

1 jar tightly sealed with C/A mixture

1 jar tightly sealed for rinsing and cleaning needles and copper wires

1 jar tightly sealed for doing the testing itself

Where to obtain the materials:

Most cities will have a hobby/school supply type store where all of the laboratory equipment except for the TLC plates can be obtained. The TLC gel plates can be obtained from Whatman Paper, Ltd., Sirchie Fingerprint Labs (800-356-7311) or Sigma-Aldrich Chemical Company (800-325-5832). 30-gauge needles and syringes are available from any drugstore, and contact lens cases usually are given away by optometrists. 16-gauge needles may be hard to locate since they have a larger diameter but can be found by contacting veterinary supplies companies.

Chemicals needed:

Dimethylformamide (DMF) - 1 oz.

1 Oz. Chloroform (small bottle)

Acetone

Sulfuric Acid

The acetone can be obtained from any paint store. The sulfuric acid is available from auto parts stores or some service stations since it is used in vehicle batteries. The other chemicals may be more difficult to locate, but chemical companies carry them. One of the authors obtained all of the chemicals and the gel test plates from the Sigma-Aldrich Chemical Company named above.

Preparation for testing of the inks:

Glass plates provide better quality of resolution and sturdiness but are more difficult to cut to the proper size and to mark. Polyester gel plates are easy to cut and mark.

Cut the gel strips 3 inches long and 1 inch wide. Mark a line in pencil $\frac{3}{4}$ inch (19mm) from the bottom edge straight across on each strip. The position of this line is important. Before placing anything for testing, on each test strip write in pencil on the very top the information regarding the sample (such as S - 1 *for sample one, etc...*) Get all of the solutions ready: The Chloroform (60%) and Acetone (40%) are mixed in one jar which should be tightly sealed since this evaporates very quickly.

Transfer a small amount of the C/A solution to the test jar in which the gel strip will be placed later. It is of utmost importance that the C/A solution does not come up to the line drawn across the bottom of the gel strip. When the gel strip is eventually placed in the test jar, the C/A solution must rise up to the ink to be tested, pass it, and keep moving in an upward direction carrying the ink being tested. Seal this test jar tightly while waiting to use it.

TLC testing:

Cut or file the end of a clean 16-gauge needle until it is flat. The needle will resemble a tiny tube. Use a file to carefully sharpen the flattened edges so that the needle can be used as a punch. Punch out an ink dot from the document with this 16-gauge needle. Various tests indicated that the punch out method is much neater than the scraping with a razor blade method. Also, when a sample is punched out, the small dot of paper carrying the ink to be tested will remain inside the needle near the blunted end used as a punch. When scraping is used to remove ink from documents, little flecks of paper and ink tend to scatter in many directions.

Once the dot has been punched out, place it in a minute quantity of DMF. This can be done in a very small jar. One suggestion is to place the dot of paper and ink in the bottom of a white contact lens case. This is easier to handle since there are

no vertical sides, therefore the access to the bottom, or extraction area, is improved. The small dot is deposited at the bottom of the lens case by using one of the copper wires to very carefully push through the needle. It was discovered that if the dot does not go to the very bottom of the lens case, it can be gently moved with the thin wire. The dot does not seem to jump away from the wire as it does if you attempt to move it around with the needle. This may be due to the difference in composition of the metals involved. Two or three drops of DMF placed on the dot of ink to be tested can be controlled much more easily by using 30-gauge needles while looking through jeweler's glasses rather than using pipettes.

As the minute amount of DMF is placed on the sample ink dot, the advantage of using a white contact lens case becomes apparent. Almost immediately, you can see the dark ink diffuse into the DMF solution because of the white background of the case. DMF will evaporate very slowly and as it does the liquid that remains is now a concentrated solution of ink. Should the DMF solution not darken, add one drop of sulfuric acid to the DMF solution and wait about one minute.

When the DMF solution has evaporated down to one drop, use a pipette or a 30-gauge needle and syringe to suck up the solution (not the paper dot). Place the drop on the line which is 3/4 inch (19mm) from the bottom of one of the gel test strips. The rate of flow of the solvent can make a difference in the separation of the dyes in the ink and the rate of flow decreases as the solvent migrates up the test strip. For this reason, it is very important that all of the samples are on the marked line so that they are all equidistant from the solvent.

Place the test strip in the jar with C/A solution making certain that the level of the solution does not come up to the 3/4 inch line on the strip. Remember that the C/A solution must work its

way up to the ink to be tested by capillary attraction and then keep rising past the line or you will not obtain any results for comparison. If the drop to be tested is below the level of the solution, the ink will just dissipate into all of the C/A solution at the bottom of the jar and none of it will go up the gel strip.

After about 15 minutes take the test strip out and let it air dry. A hemostat or an alligator metal clamp can be used to remove the test strip from the test jar. Lay the strip down in such a way that it does not touch anything while drying. The patterns and colors on the test strip will continue to develop for a while as it dries.

Tests conducted by the authors indicated that what had developed on the strips did not just disappear in a matter of minutes so there is no real urgency about taking photos for your permanent records. In these trials, both authors discovered that neither the patterns nor the colors degraded for several days. While taking a photo of the strip, be sure to include the markings made on top of the strip which identify where the samples were taken from the document (S-1, S-2 etc). Digital photos would facilitate using the computer so that two results could be overlaid and worthwhile comparisons could be made.

Evaluating the Results:

The migration of the ink components via the eluent creates a visible pattern on the TLC plate. The patterns may vary in color and form. The illustrations show some of the results of testing of different samples of ink. Note the different colors and patterns. The yellow spot over the label of S6 is part of the TLC reaction.

If significant differences are found in the patterns of two samples, you can conclude that the inks represented by these two samples are different. As in many other aspects of document examination, it is often easier to reach a conclusion that

two samples are different than to be certain that they are the same. To gain experience in the range of variation that can occur in the patterns of samples that are from the same ink, you should run a series of tests on one known ink. Also remember that TLC patterns which are the same only indicate that they originate from one "type" of ink. They do not necessarily come from one writing instrument.

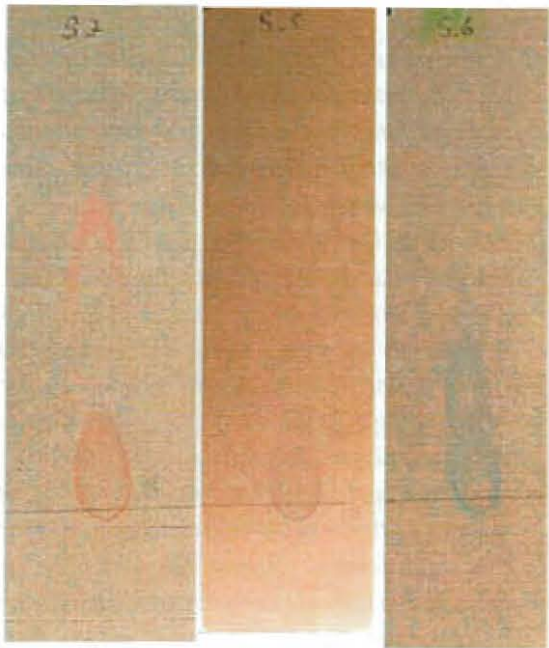
Some forensic laboratories maintain libraries of TLC results of different inks. Numeric data is obtained from the strips by calculating Rf values. Rf (Retardation Factor) is a ratio of the distance traveled by the ink material to the distance traveled by the leading edge of the eluent. In order to identify a specific ink it would be necessary to learn the techniques of correctly measuring the Rf values and accessing a database with the comparative information.

Notes:

Use clean needles to punch out each sample from the documents and be sure that each dot punched out is not contaminated with a minute amount of

ink from a previously punched out sample. After using each needle, it can be rinsed in DMF solution (in a separate rinsing jar) and air-dried or dried by blowing air through it with a syringe. Use the same caution after having used the copper wires for pushing the dots out of the needles. Keep in mind that in working with highly volatile and combustible solutions it is important to work in a well ventilated area and, of course, avoid anything that could ignite the chemicals. Since scraping or punching holes in the original documents alters them from their original forms, it is necessary to obtain proper permission prior to performing these steps.

TLC is the most widely used method for the forensic examination of writing inks because it is effective for determining the qualitative composition of colored components of inks, synthetic dyes and their side products. Colored components of other writing, printing and marking materials, such as printer inks, artists paints, copier toners and colored pencils cannot always be analyzed by using the TLC method because these components may not be soluble with most eluents applied.



TLC Illustrations:

The results of these experiments were all faint pastel colored traces which actually display better on a computer screen than on paper. These three were the most useful as printed illustrations.

Sample S-2 resulted in a light red teardrop which rose to 12 mm with a pink inverted "V" which rose to 36 mm.

Sample S-5 resulted in a Gray teardrop shape which rose to 10 mm.

Sample S-6 resulted in a Blue-Green teardrop shape rising to 20 mm. There are also vertical green and yellow bands which rose to the top of the test strip at 57 mm and overlap the sample number.

Conclusions:

TLC is a relatively simple and quick procedure provided that the proper steps are taken and extreme caution against contamination is used. It is not necessary to be an electronics expert to program your VCR, and one certainly doesn't need to be a chemist to do a valid TLC test. Interpreting the results is often more difficult than obtaining them. Experiment with several tests on known samples to fine tune your skills, and be aware of the limitations regarding possible conclusions. Keep in mind that it is of utmost importance to use only uncontaminated and fresh chemicals for all of the tests, or you may not obtain results.

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Armand-Didier Cadol, M.A., CDE, came to the USA from France. He has spent 28 years in Law Enforcement, 17 of which he was an investigator with the Teton County Sheriff's Office in Jackson Hole, Wyoming. He also spent 11 years as a college professor at two universities in Colorado where he was twice voted "Top Prof" of Colorado State University. Mr. Cadol is a member of IAI and of several local, state, national and international professional organizations. Mr. Cadol is currently president of the Teton County Peace Officer's Association. He is certified by the state of Wyoming's POST as a practitioner/lecturer in both questioned documents and fingerprint classification and identification, and has testified a number of times in both disciplines in Justice, District, and Federal Courts. Mr. Cadol will readily tell you that he feels two accomplishments of which he is most proud are becoming a US citizen and being certified by NADE.

RHYTHM IN HANDWRITING

by

Beryl Gilbertson, M.A., C.Crim.

As rhythm in movement, or lack of it, is a natural and complex attribute of the individual writer, it is difficult for another person to successfully replicate, so it can become a significant individual characteristic in any handwriting identification. Although all assessment of rhythm is, of necessity, subjective, this paper is an attempt to provide information which may give a more solid basis to such assessment.

The concept of rhythm in handwriting has been a subject of controversy for many years. As a subjectively assessed quality of handwriting, the forensic document examination literature virtually ignores it, even though it is a highly individualized characteristic of any writing and, when clearly demonstrable, should carry evidential weight. Many handwriting identifiers present assessments of the rhythmical quality of handwriting, but they have no references upon which to properly rely to determine the accuracy of their finding.

The rhythmical quality of human movement, or the lack of rhythm in movement, is very much an individual characteristic, arising from the physiological and perceptual-spatial-motor makeup of the writer. As such, it is a matter of interest to those who are involved in handwriting identification. As the forger is unlikely to have natural rhythm of movement which is identical to that of the genuine author, he/she would find rhythm difficult to replicate so that it appears naturally-produced.

Studies which meet accepted research standards mainly have been carried out by European-trained psychologists, psychiatrists and physiologists, during the time between both World Wars and immediately following World War II, when the massive development of insight into human individual functioning was being collated. The medi-

cal and neurological literature primarily discusses motor disorders of rhythm and timing, while the development of rhythmical movement is usually discussed in dance classes. Few of these even attempt to define what they mean by "rhythm," but appear to take it for granted that the word explains itself.

However, Allport and Vernon, (1933), considered rhythm to be an "indefinable something", which must be intuitively deduced. Jacoby, (1939), discusses rhythm in terms of regularity of oscillations of handwriting. Wolff (1948), discusses periodicity in relation to handwriting to include all of Nature.

Sonnemann, (1950), relates rhythm in handwriting to regularity and to form level. To Roman, (1968), rhythm is the interplay of tempo, timing, and spacing. Her definition arises out of concepts which are of German origin, particularly the theories of von Klages, in which rhythm of movement, rhythm of distribution and rhythm of form are each considered discrete facets of handwriting.

A full examination of a large body of literature reveals that where rhythm in handwriting is discussed at all, it is either a regurgitation of, or variation upon, one or more of these themes. There is an underlying commonality which explains rhythm as being (according to one's preferred terminology), regular meter, regular tempo, regular periodicity, or regular oscillations - as they apply to handwriting. The common word is "regular" and each of them suggests a "regular beat" as one finds in music and/or the use of a metronome.

It is suggested that all of these can be described as the **TIMING** of the handwriting. This is the consistency of time taken to cover the distance required for the writing trace to form like elements. As this relies upon fluid forward momentum, it applies to cursive handwriting and/or cursively written scripted handwriting (in which "air strokes" can be deduced), and not to printed samples.

The resulting regularity of like elements means that all upper-zone elements of the same kind would reach the same height and return to the same baseline level, so that, while two different letters with upper loops may be of different heights, they are consistent in height for each letter. Thus, all upper loops of, say, the letter "h" are of same height, while for the letter "l" they are of the same height, even if it is a different height from that of "h", and all letters would return to the same baseline.

The same applies to all lower-zone elements, with like elements showing descenders of the same depth, while all like middle-zone elements would reach the same height and return to the same baseline level.

In the same way, the middle-zone letters also show their consistent timing in the width taken for like elements, as well as for the spaces within them. The distance between letters and words, and other spatial organization, also remain remarkably constant, except where the writer hesitates before writing certain words or phrases, which may cause a slight increase or decrease in the space before writing recommences.

The result of all of this shows when comparison charts put together the like elements found within genuine, naturally written samples. These will clearly demonstrate that there is very little normal variation amongst like elements. Measurement of spaces and relative ratios of elements will also show less-than-average normal variation. An examiner who traces over the writing should be able to determine that the timing of the movement involved becomes automatically rhythmical, with even speed and smoothness of the writing movement. While this speed may be fast, slow or anywhere in between, it is the constancy of the speed which relates to rhythm, as well as the constancy of the distance covered by the writing trace for each element, and of the spaces.

A very slow writing with extreme regularity of timing can result in a rigid, pedantic-appearing handwriting, and such rigid writing produced with heavy pressure and muscular tension can show an unnatural, stereotyped appearance, but it is still a writing with consistent rhythm. When produced with at least average speed, this regularity of timing usually results in an aesthetically pleasing production of handwriting which is very well organized within the space provided.

It must be noted, however, that a handwriting can be extremely well-organized, with all spaces very regular and the writing extremely well placed upon the writing surface, but the individual elements of each letter and/or word can be lacking any kind of rhythm. This happens when the visual-spatial organization of the individual is highly refined, but the rhythm of movement is not.

Secondary to the regularity is a consistency of slope, which may or may not increase with speed. Certain fluid, adaptive movements in a very precisely-timed handwriting may give the impression of slope irregularities, but the criterion for judging these adaptations is whether or not they are produced in the interests of speed and efficiency of writing, without interrupting the regularity of the timing.

The difficulties of studying rhythmical timing in handwriting are many. One important area of study is the understanding of the underlying processes which are involved. The precise timing of the writing must be understood, not only as a function of individual training, practice and sophistication of handwriting, but also as a result of an extraordinary level of visual-spatial-motor coordination in the writer. It is one more instance where a full understanding of the underlying processes and the development of handwriting as it is programmed within the individual writer would be useful.

Handwriting reflects a consistent rhythm when written comfortably, in a normal writing situation. Even the most precisely rhythmical writer can exhibit dysrhythmias as a result of any of a huge number of temporary conditions, such as fatigue, illness, stress, allergy, hangover, interruptions of thought, second-language difficulty, and so on, as well as from motor difficulties such as arthritis, writer's cramp and the like.

As noted in the introduction, this paper is merely a first attempt to bring this subject into the area of discussion and to open it up to further research. Not all writings can be shown to demonstrate a rhythm which is of use to the document examiner. This is especially true when the writer has not been drilled at an early age to write precisely, which is common in our society. Where precise rhythm does exist, it can carry strong evidential weight. In unusually rhythmical modern writing, and in many historical writings which were written by people properly trained in their early years, a full investigation of elements of rhythm, can be useful. If the genuine and the questioned writing show two different rhythmical patterns, and if there is no evidence to suggest the less rhythmical handwriting is impeded by circumstances which would affect rhythm in the manner observed, one can argue this is a significant factor for a two-author opinion.

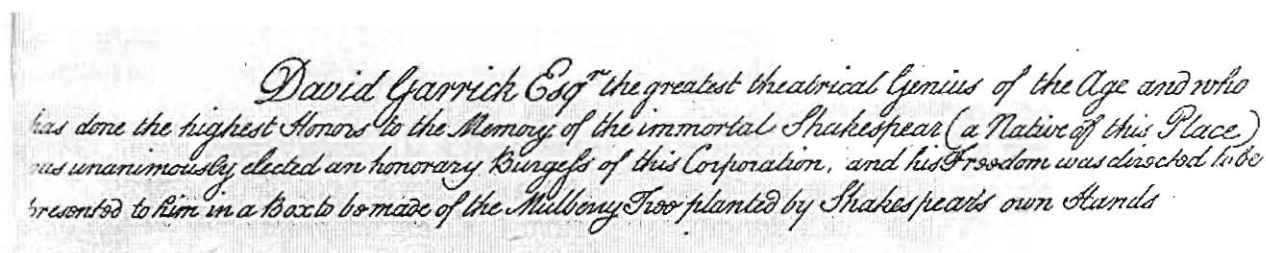
It also might be useful to investigate the rhythmical qualities of the handwritings of specific groups of people, given that they are practiced writers with no personal and/or educational impediments to their fluency. Intuitively, one might assume that certain types of athletes, dancers, and/or musicians would show a remarkably consistent rhythm, while those of other aptitudes would not. Experience suggests it is not that simple, but there are intriguing suggestions that some kind of tentative classification might be possible, if only as a working hypothesis.

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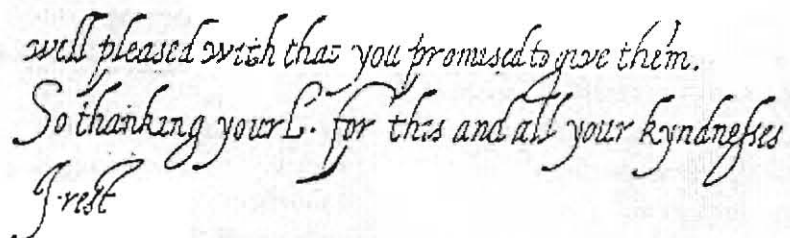
Beryl Gilbertson, M.A., C.Crim, has been a multidisciplinary investigator of normal and abnormal handwriting since 1978. She holds both an M.A. in Special Education and Neuropsychology with extra courses and a Certificate of Criminology from the University of Toronto, and is a Ph.D. candidate there. She has been consulted by police in major crimes units and has lectured at University of Toronto Extension and Humber College Continuing Education on basic understanding of the handwriting process and its disorders. Ms. Gilbertson resides and works in Toronto, Canada.

Illustrations are taken from the collection of BERYL GIBERTSON, either from original documents or from copies of documents published in 1836.



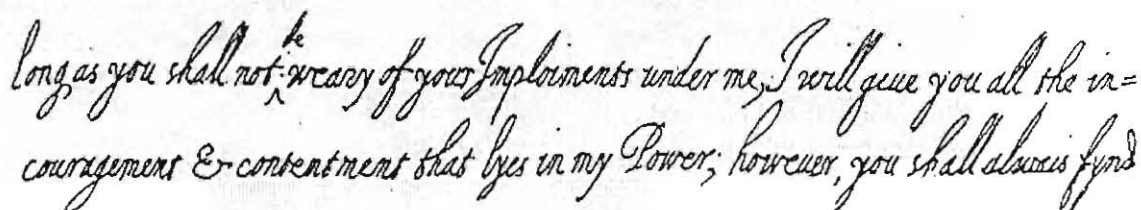
David Garrick Esq^r the greatest theatrical Genius of the Age and who has done the highest Honors to the Memory of the immortal Shakespear (a Native of this Place) was unanimously elected an honorary Burgess of this Corporation, and his Freedom was directed to be presented to him in a Box to be made of the Mulberry Tree planted by Shakespear's own Hands

Fig 1 - Exceptional rhythm in scribe's quill pen handwriting. Continual ductus, with few pen-lifts, show that the lines were written with natural, fluent rhythm.



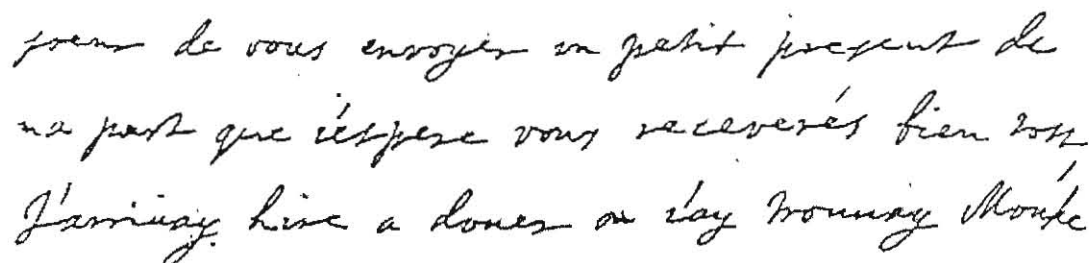
well pleased with that you promised to give them.
So thanking your L. for this and all your kindneses
I rest

Fig 2 - Quill-pen script-writing of youthful Duke of York, later Charles I, shows exceptional consistency and organization.



long as you shall not ^{be} weary of your Implements under me, I will give you all the encouragement & contentment that lyes in my Power; however, you shall always find

Fig 3 - Cursive writing of Charles I as King of England shows his rhythm and organization have not changed with maturity.



je vous envoie un petit present de
na part que j'espere vous recevrez bien
L'arrivage line a donee au lay bonnuy Monte

Fig 4 - Well organized, fast and written in his first language, the writing of Charles II, son of Charles I, is not rhythmical.

Crowd would follow them.
Would tag along. They'd, on

Fig 5 - Although the writer is a 1930's jazz musician with exceptional natural rhythm in music, his writing shows no consistent rhythm. It is likely that rhythmic writing was not well-taught and practiced, thus the transfer of natural rhythmic ability from music to penmanship is blocked.

qualified. He is warmly recommended to me
by Persons of great Distinction here, who are zealous
Friends to the American Cause. And I beg leave
to recommend him earnestly to your Excellency's

Fig 6 - In spite of embellishments, Benjamin Franklin shows excellent organization and consistent rhythm.

PRESERVING EVIDENCE

by
Sgt. Joseph M. Rosowski Sr.
Document Examination Unit
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The policies of law enforcement communities throughout the country are putting a greater emphasis on the importance of community policing. Patrol units receive personnel and manpower. Private industry, notably banks and insurance companies, continue to outsource their specialized investigation needs. These trends make the Questioned Document Examiner's work more difficult. The end result of these events further removes the Questioned Document Examiner from the core of initial and ongoing investigations. Communication and training in the area of preserving evidence are essential to overcoming these continuing policies.

Although document evidence is most commonly associated with crimes involving fraud, it can be a crucial part of any investigation of incidents ranging from threats and harassment to arson, kidnapping and homicide. It has been my experience that investigators who routinely work in the economic crime and insurance fraud arena are the investigators most familiar with document examination. And investigators with many years of experience specializing in one crime, even those assigned to homicide cases, seem to lack the basic technical knowledge to consult with a specialist. An investigator finding a firearm at a homicide location will automatically secure and confiscate it. A blank pad of paper may go unnoticed. A private investigator looking into employee theft at a law firm may search a computer for files, but what about the Post-It note pad next to the keyboard or the desk blotter?

The transcribed message identified by the impressions on that pad or blotter might reveal the identity of the perpetrator or a computer password.

A latent fingerprint or shoeprint impression on that blank paper may place the perpetrator in the room. Of course any handwriting found on a document may help to identify the writer.

Latent evidence is a type of evidence that is not readily observed by the naked eye. It is as crucial to protect a document for latent evidence as it is to protect a firearm. The protection of evidence or lack thereof may play a major role in an investigation. A prominent business leader received a threatening letter. An investigator with the good intention of submitting the letter to a document examiner placed the letter in an envelope and proceeded to write out his notes on the envelope. With the use of ESDA, a perfect impression of the investigator's handwritten notes were developed. These developed impressions obliterated any other impressions on that letter.

A female employee received threatening and suggestive letters at her place of employment through the company's mail room. The company had over 500 employees. These letters continued over a period of months. Finally, on the last letter received, an impression of a handprinted entry which appeared to be a job description that one might write for a resume or employment application was detected. Only one person at the company held those responsibilities. Although there was not enough evidence to charge the perpetrator criminally or take civil action, the harassment stopped when the perpetrator was confronted.

It is evident that in the first incident, proper procedures for the preservation of evidence were not followed. In the second incident, one might assume that the investigator followed all the procedures. This only happened after the submission of the first piece of evidence. The investigator and complainant were both instructed what to do upon receiving another letter, which was to secure the letter without opening it. Persistence rewarded everyone. It took several letters before any trace evidence was identified. The proper

procedures had been learned and practiced.

The Procedures

Initially, all documents confiscated should be guarded for the future development of latent prints and impressions **REGARDLESS OF HOW MANY PEOPLE MAY HAVE COME IN CONTACT WITH THEM UP TO THIS POINT.** If the investigation reveals that fingerprint processing is unnecessary, no harm has been done. However, if the investigator or complainant decides two weeks after the incident to process a document for latent prints, after it has been handled by himself, the complainant's family, and all his or her co-workers, then the steps necessary for the protection of evidence cannot be done retroactively. The answer to the question, "What is the first thing a person says after receiving a threatening letter?" is, "Come take a look at this." In the Woody Allen Film, "Take The Money And Run," Woody Allen presents an illegible hold-up note to a bank teller. A chain-of-evidence nightmare unfolds. All the tellers, security guards and back office people each take a turn grabbing the letter, trying to decipher his message. The sooner evidence is secured the better chance there is to obtain trace evidence from the item(s).

Prior to placing the document in an envelope, the envelope should be marked with the description and the location of the item, who recovered it and the time and date. Writing on the envelope before placing the evidence inside guards against spurious impressions on the evidence.

Minimally, the evidence should be photocopied. In the best case scenario, all evidence should be photographed. A document examiner should examine all document evidence prior to the attempt to develop latent prints. The destructive nature of the ninhydrin latent print process needs to be stressed. In some cases it is impossible to perform a full document examination and comparison after an item has been treated with ninhy-

drin, because photocopying or photographing only creates a record of the written text. The fingerprint development process may obliterate impressions, ink/pencil characteristics, overwriting, and simulated and disguised writing evidence. Experienced investigators know how the opinion of a document examiner often must be qualified when presented with only photocopies or photographs.

All investigators and complainants must be made aware of the capabilities of a document examiner and the latent evidence that may be retrieved from an item that is secured and preserved properly. Repeating the proper procedures for the preservation of document evidence during all investigations will always ensure protection.

Sgt. Joseph Rosowski has been the Questioned Document Examiner for the City of Philadelphia Police Department since 1988. As the sole Questioned Document Expert for the City, he receives cases from the Police Department, District Attorney's Office, City Solicitor's Office, Inspector General's Office, Prison Internal Affairs Division and various Federal/local task forces. Sgt. Rosowski handles 320-350 document cases per year on average.

The Forensic Document Examiner in Federal Court: Get Ready for *Daubert*

by
Robert E. Freeman, Esq.
and Theodore V. Cacioppi, Esq.

An Overview of Forensic Document Examiners as Expert Witnesses

The question of who may provide opinion testimony regarding the authenticity of questioned documents traditionally has been subject to a relaxed judicial standard.¹ This has been particularly true when the methodology employed involves comparing a known exemplar to a questioned document.² Despite the rigorous hours of training that most document examiners undertake, courts historically have viewed document examination as something other than true science. As a consequence, Courts have not considered handwriting identification and document authentication to be a field fit only for experts, and have often allowed lay persons to opine as to the authenticity of documents.³

Part of the reason why the judiciary viewed anyone claiming particular expertise related to handwriting with skepticism is the fact that the profession has a higher percentage of questionable "experts" and outright charlatans than most other fields of expertise.⁴ The range of experience seen in the profession exacerbates this problem. Additional confusion is created by the fact that, when lawyers refer to "handwriting experts," they could be referring either to people highly trained in document examination, or graphologists, who assess personality traits through handwriting samples.⁵ The former tend to belong to licensing or professional organizations, work full-time at document authentication, and have at least some laboratory equipment;⁶ the latter tend to work part-time and engage in speculative analysis.⁷ Apparently, graphology enjoys more acceptance in Europe, and graphologists have asserted that police departments in Europe have employed their principals.⁸ This article will focus on document examination and handwriting authentication. These disciplines are accepted under a much broader set of circumstances than graphology in American courts.⁹

¹ *Handwriting Identification Evidence in the Post-Daubert World*, Andre A. Moenssens, 66 UMKC L. Rev. 251, 266 (winter 1997); see also John I. Thornton & Edward F. Rhodes, *Brief History of Questioned Document Examination*, Identification News, January 1986. The traditional standard is somewhat vague, but it falls somewhere between a standard applied to a research scientist and the standard applied to a well-informed fact witness. Although forensic document examiners generally are permitted to provide testimony, they often do not receive the benefit of supportive judicial instructions to a jury that a traditional scientist receives. *Id.*

² Moenssens, *supra*, at 251.

³ *Id.* at 266-70.

⁴ See *id.* at 268. The search for a qualified forensic document examiner often entails significant effort and expense, and requires extensive screening of multiple candidates. Many judges still are wary of document examiners as experts, and often such irrelevant factors as local experience are more highly valued than objective skill. For an example of why some District Court have grown wary of anyone professing expertise in handwriting, see *United States v. Bourgeois*, 950 F.2d 980, 987 (5th Cir. 1992) (upholding lower court's disqualification of "forensic document examiner" who also professed expertise in Egyptology, psychology, hypnosis, "graphoanalysis," various religions, and metaphysics, founded on his numerous correspondence course master's degrees, when

witness was not even member of the most common forensic document examiners' organizations).

⁵ Whether personality traits can be discerned from handwriting is a matter of significant debate. See, e.g., David Crown, *A Review of Scientific Aspects of Graphology - a Handbook*, 33 J. Forensic Sci. 287 (1988) (reviewing the above entitled book, calling the title an "oxymoron"); see also Moenssens at n. 31 (collecting articles tending to show that graphologists perform at about the random level of chance in predicting personality traits).

⁶ See, e.g., Richard L. Miller, *Document Examiners: Who Is Qualified?*, 41 OCT Advocate (Idaho) 16 (1998).

⁷ *Id.*

⁸ According to INTERPOL this assertion is false. Joseph Almog, *Graphology - International Report*, Israeli Police (1979). Some critics have opined that the type of graphology practiced in Europe is not even the same sort of analysis that is practiced in the Western Hemisphere. Jan Beck, *Handwriting Identification and Graphology*, 9 J. Forensic Sci. 477 (1964).

⁹ Note as well that graphologists seem to market themselves more as speakers or consultants than expert witnesses. See <http://www.writinganalysis.com/nindex.htm>.

Evolution of the Law: Document Examiners from *Frye* to *Daubert*

For much of the Twentieth Century, the in-court admissibility of expert testimony, particularly testimony purporting to rest on a foundation of science, was governed by what was known as the *Frye* test.¹⁰ The *Frye* test mandated that expert or scientific testimony had to have a methodological foundation generally accepted in the scientific community.¹¹ For virtually this entire period, courts paid little heed to analyzing handwriting comparison under the test, and usually a reasonably articulate forensic handwriting examiner could present an expert opinion in Federal court.¹²

In 1993, the United States Supreme Court announced a dramatic change in the judicial evaluation of expert testimony. The Court, in *Daubert v. Merrell Dow Pharmaceuticals, Inc.*,¹³ abandoned the rather restrictive "general acceptance" test of *Frye* for a more liberal test based in part on the scientific method employed in the particular circumstance.¹⁴ In a landmark opinion, the Court stated that while general acceptability still played a role, a trial judge should go beyond that and ask such questions as:

- (1) whether the technique had been previously tested,
- (2) whether it conformed to the scientific method,
- (3) whether there was a known error rate,
- (4) whether there was a standard procedure to guard against errors, and/or
- (5) whether the method had been published and peer reviewed.¹⁵

The Supreme Court, in *Daubert*, mandated that the trial court play a gate-keeping role regarding the admissibility of expert testimony, and gave courts a flexible test to do so.

The Court's clear intent was for the *Daubert* test to be flexible, focusing on the methodology employed by an expert rather than the results reached. In other words, the District Court may not decide if the expert is "correct;" it may only decide if he or she applied a valid and reliable methodology.¹⁶ *Daubert* therefore allows for a "liberal policy of admissibility" so long as the opinions are reliable.¹⁷ The District Court must determine if the data underlying the expert's opinion is "reasonably relied on by experts."¹⁸ Importantly, *Daubert* does not require that the expert's opinion and methodology be perfect. Indeed, the

¹⁰ *Frye v. United States*, 293 F. 1013 (D.C. Cir. 1923).

¹¹ *Id.*; see Faust F. Rossi, *Expert Witnesses*, 1991. Each time a novel approach was presented to a court, the *Frye* test was employed to judge its admissibility. This has included polygraph testing, DNA analysis, gunpowder residue tests, and any number of psychological tests. *Symposium on Science and the Rules of Evidence*, 99 F.R.D. 187 (1983); Rossi at 25-29.

¹² See e.g., *United States v. Ostertag*, 619 F.2d 767, 771 (8th Cir. 1980) (accepting "handwriting evidence" under *Frye* with little discussion); *United States v. Buck*, 1987 WL 19300 (S.D.N.Y. 1987) (rejecting notion that handwriting comparison was inadmissible under *United States v. Williams*, 583 F.2d 1194 (2d Cir.1978), thus finding that *Frye* did not govern the admissibility of this evidence); *United States v. Marler*, 614 F.2d 47 (5th Cir. 1980) (allowing forensic document examiner to testify with no discussion of *Frye* test).

¹³ 509 U.S. 579 (1993). The *Daubert* plaintiffs claimed that the defendant's morning sickness drug caused birth defects. The lower court held that since the plaintiffs' experts' unique re-examination of existing relevant studies had been prepared

for litigation, and therefor were not generally accepted in the relevant scientific community, they did not meet the *Frye* standard. On appeal, the Supreme Court held that the *Frye* test had not survived the enactment of F.R.E. 702.

¹⁴ The Supreme Court in *Daubert* interpreted Federal Rule of Evidence 702, which reads: "If scientific, technical, or other specialized knowledge will assist the trier of fact to understand the evidence or to determine a fact in issue, a witness qualified as an expert by knowledge, skill, experience, training, or education, may testify thereto in the form of an opinion or otherwise."

¹⁵ *Daubert*, 509 U.S. at 592-94; see also e.g. G. Michael Fenner, *The Daubert Handbook: The Case, It's Essential Dilemma, and It's Progeny*, 29 Creighton L. Rev. 939 (1996).

¹⁶ *In re Paoli R.R. Yard PCB Litigation*, 53 F.3d 717, 741-44 (3rd Cir. 1994) cert. denied, 513 U.S. 1190 (1995).

¹⁷ *Id.* at 741, 744.

¹⁸ *Id.* at 748.

Court should admit the testimony even if it believes that the expert's technique has flaws that may render the conclusions inaccurate.¹⁹ The remedy for such perceived inaccuracies is the same remedy applied to seemingly inaccurate fact witnesses: "vigorous cross examination, presentation of contrary evidence, and careful instruction on the burden of proof are the traditional and appropriate means of attacking shaky but admissible evidence."²⁰

Based on a review of post-*Daubert* cases, forensic document examiners were generally not subject to the *Daubert* test.²¹ Many courts focused on the fact that forensic document examination relies on somewhat subjective techniques and is not amenable to statistical or empirical verification.²² Such courts lumped forensic document examiners into the same category as engineers, technicians, mechanics, and other non-scientists with "specialized knowledge."²³ Thus, forensic document examiners have generally not been subject to so-called *Daubert* hearings in which they would be cross-examined in a pre-trial setting

regarding methodology and techniques, after which the Court would decide whether to admit or exclude the testimony.

***Kumho*: The Blowout That Changes Everything**

On March 23, 1999, the Supreme Court once again altered the legal landscape that expert witnesses must tread and attorneys must address. In *Kumho Tire Company, Ltd. v. Carmichael*,²⁴ the Court expanded the *Daubert* standard to cover *all* expert testimony, not just the testimony of traditional scientists. Under *Kumho*, all "technical" experts are subject to a *Daubert* analysis. This change will almost certainly be applied to document examiners of all types.

The *Kumho* case began on July 6, 1993 when the rear tire of a minivan driven by Patrick Carmichael blew out.²⁵ One passenger died, and everyone in the vehicle (mostly Carmichael family members) was severely injured. In late 1993, the Carmichaels brought suit against the manu-

¹⁹ *Id.* at 744-45.

²⁰ *Daubert*, 509 U.S. at 595.

²¹ This was true in theory, although many forensic document examiners may have experienced a *Daubert* hearing. Since most cases settle, this error on the part of the relevant district court would be moot. In any case, since forensic document examiners opine in the technical rather than scientific realm, they usually should not have been subject to a *Daubert* analysis. In *United States v. Starzecpyzel*, 880 F.Supp. 1027 (S.D.N.Y. 1995), for example, the Court found that forensic document examiners fell within the "other specialized knowledge" language of F.R.E. 702, and were not subject to a *Daubert* analysis since they were more akin to technicians or engineers rather than scientists. The Court found forensic document examiner testimony to be sufficiently reliable to present to the jury on its own merits, without the need for a *Daubert* test. *Starzecpyzel*, 880 F.Supp. at 1029. The Sixth Circuit Court of Appeals followed suit in *United States v. Jones*, 107 F.3d 1147 (6th Cir. 1997). Note, however, that some Federal Circuits have subjected technical experts to a *Daubert* test, and, in those circuits, document examiners may have found themselves subject to a *Daubert* hearing. See n. 24 *infra*.

²² E.g. *Jones*, 107 F.3d at 1157; *Starzecpyzel*, 880 F.Supp. at 1027.

²³ Overall, the Circuits were divided on the issue of whether expert testimony based on experience or specialized knowledge was to be analyzed under *Daubert*. Compare *Watkins v. Telsmith, Inc.*, 121 F.3d 984, 990-991 (5th Cir. 1997) (applying *Daubert* to exclude testimony of engineer); *United States v. Cordoba*, 104 F.3d 225, 230 (9th Cir.1997) (*Daubert* not applicable to testimony regarding *modus operandi* of drug traffickers); *United States v. Webb*, 115 F.3d 711 (9th Cir.1997) (*Daubert* not applied to expert testimony as to why people typically hide guns in the engine compartments of their cars); *Cummins v. Lyle Indus.*, 93 F.3d 362, 366-371 (7th Cir.1996) (*Daubert* applied to testimony of human factors expert regarding adequacy of warning labels); *Pestel v. Vermeer Mfg. Co.*, 64 F.3d 382 (8th Cir.1995) (evidence of expert's proposed alternative engineering design excluded on basis of *Daubert*); *Compton v. Subaru of America, Inc.*, 82 F.3d 1513, 1518-19 (10th Cir.) (not applying *Daubert* to testimony of automobile engineering expert whose opinion was based on decades of experience), *cert. denied*, 519 U.S. 1042 (1996). The majority of courts were not inclined to subject a forensic document examiner, or any other "technician," to a *Daubert* hearing.

²⁴ ___ S.Ct. ___, 1999 WL 152275.

²⁵ *Kumho* at I. Pagination references were unavailable for *Kumho* when this article was written. The Court divided the opinion into numbered sections, and all references to *Kumho* in this article are to those numbered sections.

facturer and distributor of the tire. The Carmichael's case relied in large part on the testimony of Dennis Carlson, Jr., an expert in tire failure analysis. Carlson provided deposition testimony that based on his detailed examination of the tire, despite the tire's age, wear, and two inadequately repaired punctures, a manufacturing defect was responsible for the blowout and resulting injuries. Carlson intended to offer similar testimony at trial.²⁶

The defendants strongly disputed certain of Carlson's underlying assumptions. For example, Carlson had opined that if certain physical symptoms were not present in the tire, the cause of the accident must have been a manufacturing defect. Specifically, he stated that if the blowout were not caused by "over-deflection," *i.e.* misusing the tire by under-inflating and/or overloading it, some sort of manufacturing defect must have caused the blowout.²⁷ Carlson further opined that tire misuse would be detectable by certain physical symptoms such as uneven tread wear, bead grooving, side-wall deterioration, and/or rim flange discoloration.²⁸ His inspection of the tire did reveal some of these symptoms of abuse, but he testified that they were insignificant. Carlson concluded that since the tire did not show at least two signs of over-deflection to any significant degree, the blowout must have been caused by a manufacturing defect.²⁹

The District Court granted the defendants' motion for a *Daubert* hearing even though it considered Carlson's testimony technical rather than

scientific.³⁰ After a hearing, the Court found that Carlson's methodology did not live up to the *Daubert* standards, *i.e.*, peer review, the existence of a known error rate, and the degree of acceptance within the relevant scientific community.³¹ It thus excluded Carlson's testimony, and, since the plaintiffs' case rested so heavily on that testimony, granted the defendants' motion for summary judgment.³²

The plaintiffs appealed to the Eleventh Circuit Court of Appeals, which reversed.³³ The appellate court found that the *Daubert* decision was only to be applied to opinions based in a "scientific context" and not to opinions based on "skill or experience based observations."³⁴ It remanded the case back to the District Court for consideration under a non-*Daubert* standard.³⁵ Kumho Tire appealed to the Supreme Court, which chose to take the case to resolve the dispute among the federal appellate courts as to whether technical experts were subject to a *Daubert* test.³⁶

The Supreme Court first delved into the plain language of Rule 702 itself. The Court explained that the rule is worded in a way that draws no relevant distinction between "technical" and "scientific" experts.³⁷ The Court admitted that its original opinion in *Daubert* may have caused some confusion since it only referred to "scientific" evidence, but explained that it limited itself to that terminology in *Daubert* because that was the only sort of evidence at issue in that particular case.³⁸ Justice Breyer, the author of the *Kumho* opinion, went on to explain that the rationale behind the

²⁶ *Id.*

²⁷ *Id.*

²⁸ *Id.*

²⁹ *Kumho* at I.

³⁰ *Carmichael v. Samyang Tires, Inc.*, 923 F.Supp. 1514, 1521-22 (S.D. Ala. 1996).

³¹ *Id.* at 1520.

³² *Id.*

³³ *Carmichael v. Samyang Tire, Inc.*, 131 F.3d 1433 (1997).

³⁴ *Id.* at 1435-1436.

³⁵ *Id.* at 1436.

³⁶ *Kumho* at I; see n. 23 *supra* and accompanying text.

³⁷ *Kumho* at II(A).

³⁸ *Id.*

Daubert “gatekeeper” ruling applied equally to both “technical” and “scientific” evidence.³⁹ Furthermore, there is no bright line between “technical” and “scientific” evidence; the reality is that the line is significantly blurred, if not indiscernible, and thus a rule based on this distinction would likely be unworkable.⁴⁰ The Court concluded that, as theoretical matter, the purpose of Rule 702 was to allow a jury to hear testimony explaining matters the average juror could not fairly evaluate, and it makes no difference whether this testimony is based on “experience” or “science.”⁴¹

The Supreme Court next addressed the proper analysis to be applied to expert testimony, and found that the factors previously articulated in *Daubert* (testability, peer review, rate of error, and general acceptance) may be helpful in some cases and may be inapplicable in others.⁴² Therefore, District Courts must have wide latitude in determining which reliability tests are applicable to each case, and must shape the analysis to fit the expert and his/her type of opinion.⁴³ According to the Supreme Court, the factors originally set forth in *Daubert* are merely helpful, and certainly not definitive.⁴⁴ The District Court is best positioned to properly evaluate the expert’s testimony, and it would be impossible to articulate a mechanical test of reliability applicable to all cases.⁴⁵ The Supreme Court did state that there will be occasions to apply the standard *Daubert* tests to unique opinions – i.e., the District Court

could inquire into the identification error rate of a perfume tester asked to distinguish between various odors, or how often an engineer’s “experience based methodology has produced erroneous results, or whether such a method is generally accepted in the relevant engineering community.”⁴⁶ The latter statement bears particular relevance for document examiners, who will have to be prepared to demonstrate that their specific techniques, equipment, and methodology are accepted as valid within the forensic document examiner community.

In *Kumho*, the Supreme Court simultaneously applied *Daubert* to all experts, and liberalized the *Daubert* test significantly. Importantly, the Supreme Court in no way diminished the gatekeeper function of the District Courts.⁴⁷ A District Court still must consider the original *Daubert* factors, but only when they are applicable to the case at hand.⁴⁸ District Courts are to be given significant leeway in their *Daubert* related decision, which are to only be reviewed under the “abuse of discretion” standard by appellate courts.⁴⁹

The Supreme Court offered additional guidance to lower courts in the application of *Daubert* to technical opinions by analyzing Carlson’s “defective tire” methodology. In *Kumho*, the relevant issue was whether Carlson could reasonably determine the cause of the blowout using the meth-

³⁹ *Id.*

⁴⁰ *Id.*

⁴¹ *Kumho* at II(A).

⁴² *Kumho* at II(B).

⁴³ *Id.*

⁴⁴ *Id.*

⁴⁵ *Id.*

⁴⁶ *Kumho* at II(B).

⁴⁷ *Id.*

⁴⁸ *Id.*

⁴⁹ *Kumho* at II(C). Although this distinction is perhaps more relevant to attorneys than expert witnesses, it does clearly send a signal District Court judges that their *Daubert* rulings will, in all likelihood, be upheld on appeal.

odology that he employed.⁵⁰ Carlson had articulated both an explicit theory (that without two signs of abuse the blowout must have been caused by a defect) and an implicit proposition (that his tactile and visual inspection could accurately find signs of abuse).⁵¹ The Supreme Court stated that the District Court had properly found Carlson's methodology unreliable based on serious inconsistencies in his report and between the report and his testimony, the fact that he could not accurately describe various objective characteristics of the tire (such as a mileage estimate) through his inspection, and Carlson's inability to articulate any objective, replicable way to inspect a tire.⁵² The Supreme Court further relied on the fact that no one in the tire industry used Carlson's two-factor test to measure tire characteristics. In fact, his overall methodology had never been articulated in any relevant journal.⁵³ The Supreme Court found particularly persuasive the fact that the District Court had specifically stated that it applied *Daubert* in a flexible manner, attempting to tailor it to the specifics of the case, and simply found Carlson to be unreliable as an expert.⁵⁴

Conclusion: In the Future, More and More Experts Will Face *Daubert* Challenge

In light of *Kumho*, experts of all types should now expect *Daubert* hearings in Federal cases. Although the Court apparently liberalized the *Daubert* standard to some extent in *Kumho*,⁵⁵ it did make clear that *Daubert* will remain the legal test applicable to expert witnesses. The Court also re-affirmed the traditional *Daubert* factors –

peer review, error rate, general acceptance, and testability – but mandated that they be applied in a flexible way when possible, and jettisoned when inapplicable. Forensic document examiners, and the attorneys who utilize their expertise, should thus be prepared for such challenges, and must be ready to articulate ways in which the art and science of forensic document examination fits within the traditional *Daubert* framework. A document examiner must be prepared, whenever possible, to stress the more scientific aspects of the profession, such as ink and paper analysis, and explain how the methodology he or she employs is replicable, objective, and widely accepted throughout the forensic document examiner community.

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⁵⁰ *Id.*

⁵¹ *Id.*

⁵² *Id.*

⁵³ The Court cited to a number of tire industry publications, none of which supported Carlson. *See id.*

⁵⁴ *Kumho* at 11(C).

⁵⁵ "[T]he *Daubert* factors are not holy writ . . ." *Kumho* at concurrence by Justice Scalia, joined by Justice O'Connor and Justice Thomas.

SUPREME COURT OF THE UNITED STATES

**KUMHO TIRE CO., LTD., et al. v.
CARMICHAEL et al.**

**CERTIORARI TO THE UNITED
STATES COURT OF APPEALS FOR THE
ELEVENTH CIRCUIT**

No. 97—1709. Argued December 7, 1998—
Decided March 23, 1999

Syllabus

NOTE: Where it is feasible, a syllabus (headnote) will be released, as is being done in connection with this case, at the time the opinion is issued. The syllabus constitutes no part of the opinion of the Court but has been prepared by the Reporter of Decisions for the convenience of the reader.

When a tire on the vehicle driven by Patrick Carmichael blew out and the vehicle overturned, one passenger died and the others were injured. The survivors and the decedent's representative, respondents here, brought this diversity suit against the tire's maker and its distributor (collectively Kumho Tire), claiming that the tire that failed was defective. They rested their case in significant part upon the depositions of a tire failure analyst, Dennis Carlson, Jr., who intended to testify that, in his expert opinion, a defect in the tire's manufacture or design caused the blow out. That opinion was based upon a visual and tactile inspection of the tire and upon the theory that in the absence of at least two of four specific, physical symptoms indicating tire abuse, the tire failure of the sort that occurred here was caused by a defect. Kumho Tire moved to exclude Carlson's testimony on the ground that his methodology failed to satisfy Federal Rule of Evidence 702, which says: "If scientific, technical, or other specialized knowledge will assist the trier of fact . . . , a witness qualified as

an expert . . . may testify thereto in the form of an opinion." Granting the motion (and entering summary judgment for the defendants), the District Court acknowledged that it should act as a reliability "gatekeeper" under *Daubert v. Merrell Dow Pharmaceuticals, Inc.*, 509 U. S. 579, 589, in which this Court held that Rule 702 imposes a special obligation upon a trial judge to ensure that scientific testimony is not only relevant, but reliable. The court noted that *Daubert* discussed four factors—testing, peer review, error rates, and "acceptability" in the relevant scientific community—which might prove helpful in determining the reliability of a particular scientific theory or technique, *id.*, at 593—594, and found that those factors argued against the reliability of Carlson's methodology. On the plaintiffs' motion for reconsideration, the court agreed that *Daubert* should be applied flexibly, that its four factors were simply illustrative, and that other factors could argue in favor of admissibility. However, the court affirmed its earlier order because it found insufficient indications of the reliability of Carlson's methodology. In reversing, the Eleventh Circuit held that the District Court had erred as a matter of law in applying *Daubert*. Believing that *Daubert* was limited to the scientific context, the court held that the *Daubert* factors did not apply to Carlson's testimony, which it characterized as skill- or experience-based.

Held:

1. The *Daubert* factors may apply to the testimony of engineers and other experts who are not scientists. Pp. 7—13.

(a) The *Daubert* "gatekeeping" obligation applies not only to "scientific" testimony, but to all expert testimony. Rule 702 does not distinguish between "scientific" knowledge and "technical" or "other specialized" knowledge, but makes clear that any such knowledge might become the subject of expert testimony. It is the Rule's word "knowledge," not the words (like "scientific") that modify that word, that establishes a standard of evidentiary reliability. 509 U.S., at 589—590. *Daubert* re-

ferred only to “scientific” knowledge because that was the nature of the expertise there at issue. *Id.*, at 590, n. 8. Neither is the evidentiary rationale underlying *Daubert*’s “gatekeeping” determination limited to “scientific” knowledge. Rules 702 and 703 grant all expert witnesses, not just “scientific” ones, testimonial latitude unavailable to other witnesses on the assumption that the expert’s opinion will have a reliable basis in the knowledge and experience of his discipline. *Id.*, at 592. Finally, it would prove difficult, if not impossible, for judges to administer evidentiary rules under which a “gatekeeping” obligation depended upon a distinction between “scientific” knowledge and “technical” or “other specialized” knowledge, since there is no clear line dividing the one from the others and no convincing need to make such distinctions. Pp. 7—9.

(b) A trial judge determining the admissibility of an engineering expert’s testimony *may* consider one or more of the specific *Daubert* factors. The emphasis on the word “may” reflects *Daubert*’s description of the Rule 702 inquiry as “a flexible one.” 509 U.S., at 594. The *Daubert* factors do *not* constitute a definitive checklist or test, *id.*, at 593, and the gatekeeping inquiry must be tied to the particular facts, *id.*, at 591. Those factors may or may not be pertinent in assessing reliability, depending on the nature of the issue, the expert’s particular expertise, and the subject of his testimony. Some of those factors may be helpful in evaluating the reliability even of experience-based expert testimony, and the Court of Appeals erred insofar as it ruled those factors out in such cases. In determining whether particular expert testimony is reliable, the trial court should consider the specific *Daubert* factors where they are reasonable measures of reliability. Pp. 10—12.

(c) The court of appeals must apply an abuse-of-discretion standard when it reviews the trial court’s decision to admit or exclude expert testimony. *General Electric Co. v. Joiner*, 522 U.

S. 136, 138-139. That standard applies as much to the trial court’s decisions about how to determine reliability as to its ultimate conclusion. Thus, whether *Daubert*’s specific factors are, or are not, reasonable measures of reliability in a particular case is a matter that the law grants the trial judge broad latitude to determine. See *id.*, at 143. The Eleventh Circuit erred insofar as it held to the contrary. P. 13.

2. Application of the foregoing standards demonstrates that the District Court’s decision not to admit Carlson’s expert testimony was lawful. The District Court did not question Carlson’s qualifications, but excluded his testimony because it initially doubted his methodology and then found it unreliable after examining the transcript in some detail and considering respondents’ defense of it. The doubts that triggered the court’s initial inquiry were reasonable, as was the court’s ultimate conclusion that Carlson could not reliably determine the cause of the failure of the tire in question. The question was not the reliability of Carlson’s methodology in general, but rather whether he could reliably determine the cause of failure of *the particular tire at issue*. That tire, Carlson conceded, had traveled far enough so that some of the tread had been worn bald, it should have been taken out of service, it had been repaired (inadequately) for punctures, and it bore some of the very marks that he said indicated, not a defect, but abuse. Moreover, Carlson’s own testimony cast considerable doubt upon the reliability of both his theory about the need for at least two signs of abuse and his proposition about the significance of visual inspection in this case. Respondents stress that other tire failure experts, like Carlson, rely on visual and tactile examinations of tires. But there is no indication in the record that other experts in the industry use Carlson’s *particular* approach or that tire experts normally make the very fine distinctions necessary to support his conclusions, nor are there references to articles or papers that validate his approach. Respondents’ argument that the District Court too rigidly applied *Daubert*

might have had some validity with respect to the court's initial opinion, but fails because the court, on reconsideration, recognized that the relevant reliability inquiry should be "flexible," and ultimately based its decision upon Carlson's failure to satisfy either *Daubert's* factors or any other set of reasonable reliability criteria. Pp. 13—19.

131 F.3d 1433, reversed.

Breyer, J., delivered the opinion of the Court, in which Rehnquist, C. J., and O'Connor, Scalia, Kennedy, Souter, Thomas, and Ginsburg, JJ., joined, and in which Stevens, J., joined as to Parts I and II. Scalia, J., filed a concurring opinion, in which O'Connor and Thomas, JJ., joined. Stevens, J., filed an opinion concurring in part and dissenting in part.

Opinion of the Court

NOTICE: This opinion is subject to formal revision before publication in the preliminary print of the United States Reports. Readers are requested to notify the Reporter of Decisions, Supreme Court of the United States, Washington, D. C. 20543, of any typographical or other formal errors, in order that corrections may be made before the preliminary print goes to press.

SUPREME COURT OF THE UNITED STATES

No. 97—1709

**KUMHO TIRE COMPANY, LTD.,
et al., PETITIONERS
v. PATRICK CARMICHAEL, etc.,
et al.**

ON WRIT OF CERTIORARI TO THE UNITED STATES COURT OF APPEALS FOR THE ELEVENTH CIRCUIT

[March 23, 1999]

Justice Breyer delivered the opinion of the Court.

In *Daubert v. Merrell Dow Pharmaceuticals, Inc.*, 509 U. S. 579 (1993), this Court focused upon the admissibility of scientific expert testimony. It pointed out that such testimony is admissible only if it is both relevant and reliable. And it held that the Federal Rules of Evidence "assign to the trial judge the task of ensuring that an expert's testimony both rests on a reliable foundation and is relevant to the task at hand." *Id.*, at 597. The Court also discussed certain more specific factors, such as testing, peer review, error rates, and "acceptability" in the relevant scientific community, some or all of which might prove helpful in determining the reliability of a particular scientific "theory or technique." *Id.*, at 593—594.

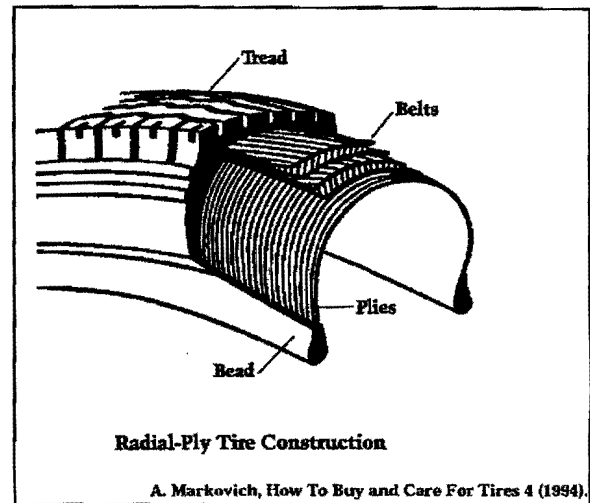
This case requires us to decide how *Daubert* applies to the testimony of engineers and other experts who are not scientists. We conclude that *Daubert's* general holding—setting forth the trial judge's general "gatekeeping" obligation—applies not only to testimony based on "scientific" knowledge, but also to testimony based on "technical" and "other specialized" knowledge. See Fed. Rule Evid. 702. We also conclude that a trial court may consider one or more of the more specific factors that *Daubert* mentioned when doing so will help determine that testimony's reliability. But, as the Court stated in *Daubert*, the test of reliability is "flexible," and *Daubert's* list of specific factors neither necessarily nor exclusively applies to all experts or in every case. Rather, the law grants a district court the same broad latitude when it decides *how* to determine reliability as it enjoys in respect to its ultimate reliability determination. See *General Electric Co. v. Joiner*, 522 U. S. 136, 143 (1997) (courts of appeals are to apply "abuse of discretion" standard when

reviewing district court's reliability determination). Applying these standards, we determined that the District Court's decision in this case—not to admit certain expert testimony—was within its discretion and therefore lawful.

I

On July 6, 1993, the right rear tire of a minivan driven by Patrick Carmichael blew out. In the accident that followed, one of the passengers died, and others were severely injured. In October 1993, the Carmichaels brought this diversity suit against the tire's maker and its distributor, whom we refer to collectively as Kumho Tire, claiming that the tire was defective. The plaintiffs rested their case in significant part upon deposition testimony provided by an expert in tire failure analysis, Dennis Carlson, Jr., who intended to testify in support of their conclusion.

Carlson's depositions relied upon certain features of tire technology that are not in dispute. A steel-belted radial tire like the Carmichaels' is made up of a "carcass" containing many layers of flexible cords, called "plies," along which (between the cords and the outer tread) are laid steel strips called "belts." Steel wire loops, called "beads," hold the cords together at the plies' bottom edges. An outer layer, called the "tread," encases the carcass, and the entire tire is bound together in rubber, through the application of heat and various chemicals. See generally, *e.g.*, J. Dixon, *Tires, Suspension and Handling* 68—72 (2d ed. 1996). The bead of the tire sits upon a "bead seat," which is part of the wheel assembly. That assembly contains a "rim flange," which extends over the bead and rests against the side of the tire. See M. Mavrigian, *Performance Wheels & Tires* 81, 83 (1998) (illustrations). A. Markovich, *How To Buy and Care For Tires* 4 (1994).



Carlson's testimony also accepted certain background facts about the tire in question. He assumed that before the blowout the tire had traveled far. (The tire was made in 1988 and had been installed some time before the Carmichaels bought the used minivan in March 1993; the Carmichaels had driven the van approximately 7,000 additional miles in the two months they had owned it.) Carlson noted that the tire's tread depth, which was $11/32$ of an inch when new, App. 242, had been worn down to depths that ranged from $3/32$ of an inch along some parts of the tire, to nothing at all along others. *Id.*, at 287. He conceded that the tire tread had at least two punctures which had been inadequately repaired. *Id.*, at 258—261, 322.

Despite the tire's age and history, Carlson concluded that a defect in its manufacture or design caused the blow-out. He rested this conclusion in part upon three premises which, for present purposes, we must assume are not in dispute: First, a tire's carcass should stay bound to the inner side of the tread for a significant period of time after its tread depth has worn away. *Id.*, at 208—209. Second, the tread of the tire at issue had separated from its inner steel-belted carcass prior to the accident. *Id.*, at 336. Third, this "separation" caused the blowout. *Ibid.*

Carlson's conclusion that a defect caused the separation, however, rested upon certain other propositions, several of which the defendants strongly dispute. First, Carlson said that if a separation is *not* caused by a certain kind of tire misuse called "overdeflection" (which consists of underinflating the tire or causing it to carry too much weight, thereby generating heat that can undo the chemical tread/carcass bond), then, ordinarily, its cause is a tire defect. *Id.*, at 193—195, 277—278. Second, he said that if a tire has been subject to sufficient overdeflection to cause a separation, it should reveal certain physical symptoms. These symptoms include (a) tread wear on the tire's shoulder that is greater than the tread wear along the tire's center, *Id.*, at 211; (b) signs of a "bead groove," where the beads have been pushed too hard against the bead seat on the inside of the tire's rim, *Id.*, at 196—197; (c) sidewalls of the tire with physical signs of deterioration, such as discoloration, *Id.*, at 212; and/or (d) marks on the tire's rim flange, *Id.*, at 219—220. Third, Carlson said that where he does not find *at least two* of the four physical signs just mentioned (and presumably where there is no reason to suspect a less common cause of separation), he concludes that a manufacturing or design defect caused the separation. *Id.*, at 223—224.

Carlson added that he had inspected the tire in question. He conceded that the tire to a limited degree showed greater wear on the shoulder than in the center, some signs of "bead groove," some discoloration, a few marks on the rim flange, and inadequately filled puncture holes (which can also cause heat that might lead to separation). *Id.*, at 256—257, 258—261, 277, 303—304, 308. But, in each instance, he testified that the symptoms were not significant, and he explained why he believed that they did not reveal overdeflection. For example, the extra shoulder wear, he said, appeared primarily on one shoulder, whereas an overdeflected tire would reveal equally abnormal wear on both shoulders. *Id.*, at 277. Carlson con-

cluded that the tire did not bear at least two of the four overdeflection symptoms, nor was there any less obvious cause of separation; and since neither overdeflection nor the punctures caused the blowout, a defect must have done so.

Kumho Tire moved the District Court to exclude Carlson's testimony on the ground that his methodology failed Rule 702's reliability requirement. The court agreed with Kumho that it should act as a *Daubert*-type reliability "gatekeeper," even though one might consider Carlson's testimony as "technical," rather than "scientific." See *Carmichael v. Samyang Tires, Inc.*, 923 F. Supp. 1514, 1521—1522 (SD Ala. 1996). The court then examined Carlson's methodology in light of the reliability-related factors that *Daubert* mentioned, such as a theory's testability, whether it "has been a subject of peer review or publication," the "known or potential rate of error," and the "degree of acceptance . . . within the relevant scientific community." 923 F. Supp., at 1520 (citing *Daubert*, 509 U.S., at 592—594). The District Court found that all those factors argued against the reliability of Carlson's methods, and it granted the motion to exclude the testimony (as well as the defendants' accompanying motion for summary judgment).

The plaintiffs, arguing that the court's application of the *Daubert* factors was too "inflexible," asked for reconsideration. And the Court granted that motion. *Carmichael v. Samyang Tires, Inc.*, Civ. Action No. 93—0860—CB—S (SD Ala., June 5, 1996), App. to Pet. for Cert. 1c. After reconsidering the matter, the court agreed with the plaintiffs that *Daubert* should be applied flexibly, that its four factors were simply illustrative, and that other factors could argue in favor of admissibility. It conceded that there may be widespread acceptance of a "visual-inspection method" for some relevant purposes. But the court found insufficient indications of the reliability of "the component of Carlson's tire failure analysis which most concerned the Court, namely, the methodology

employed by the expert in analyzing the data obtained in the visual inspection, and the scientific basis, if any, for such an analysis.” *Id.*, at 6c.

It consequently affirmed its earlier order declaring Carlson’s testimony inadmissible and granting the defendants’ motion for summary judgment.

The Eleventh Circuit reversed. See *Carmichael v. Samyang Tire, Inc.*, 131 F.3d 1433 (1997). It “review[ed] ... *de novo*” the “district court’s legal decision to apply *Daubert*.” *Id.*, at 1435. It noted that “the Supreme Court in *Daubert* explicitly limited its holding to cover only the ‘scientific context,’ ” adding that “a *Daubert* analysis” applies only where an expert relies “on the application of scientific principles,” rather than “on skill- or experience-based observation.” *Id.*, at 1435—1436. It concluded that Carlson’s testimony, which it viewed as relying on experience, “falls outside the scope of *Daubert*,” that “the district court erred as a matter of law by applying *Daubert* in this case,” and that the case must be remanded for further (non-*Daubert*-type) consideration under Rule 702. *Id.*, at 1436.

Kumho Tire petitioned for certiorari, asking us to determine whether a trial court “may” consider *Daubert*’s specific “factors” when determining the “admissibility of an engineering expert’s testimony.” Pet. for Cert. i. We granted certiorari in light of uncertainty among the lower courts about whether, or how, *Daubert* applies to expert testimony that might be characterized as based not upon “scientific” knowledge, but rather upon “technical” or “other specialized” knowledge. Fed. Rule Evid. 702; compare, *e.g.*, *Watkins v. Telsmith, Inc.*, 121 F.3d 984, 990—991 (CA5 1997), with, *e.g.*, *Compton v. Subaru of America, Inc.*, 82 F.3d 1513, 1518—1519 (CA10), cert. denied, 519 U. S. 1042 (1996).

II

A

In *Daubert*, this Court held that Federal Rule of Evidence 702 imposes a special obligation upon a trial judge to “ensure that any and all scientific testimony ... is not only relevant, but reliable,” 509 U.S., at 589. The initial question before us is whether this basic gatekeeping obligation applies only to “scientific” testimony or to all expert testimony. We, like the parties, believe that it applies to all expert testimony. See Brief for Petitioners 19; Brief for Respondents 17.

For one thing, Rule 702 itself says:

“If scientific, technical, or other specialized knowledge will assist the trier of fact to understand the evidence or to determine a fact in issue, a witness qualified as an expert by knowledge, skill, experience, training, or education, may testify thereto in the form of an opinion or otherwise.”

This language makes no relevant distinction between “scientific” knowledge and “technical” or “other specialized” knowledge. It makes clear that any such knowledge might become the subject of expert testimony. In *Daubert*, the Court specified that it is the Rule’s word “knowledge,” not the words (like “scientific”) that modify that word, that “establishes a standard of evidentiary reliability.” 509 U.S., at 589—590. Hence, as a matter of language, the Rule applies its reliability standard to all “scientific,” “technical,” or “other specialized” matters within its scope. We concede that the Court in *Daubert* referred only to “scientific” knowledge. But as the Court there said, it referred to “scientific” testimony “because that [wa]s the nature of the expertise” at issue. *Id.*, at 590, n. 8.

Neither is the evidentiary rationale that underlay the Court’s basic *Daubert* “gatekeeping” determination limited to “scientific” knowledge.

Daubert pointed out that Federal Rules 702 and 703 grant expert witnesses testimonial latitude unavailable to other witnesses on the “assumption that the expert’s opinion will have a reliable basis in the knowledge and experience of his discipline.” *Id.*, at 592 (pointing out that experts may testify to opinions, including those that are not based on firsthand knowledge or observation). The Rules grant that latitude to all experts, not just to “scientific” ones.

Finally, it would prove difficult, if not impossible, for judges to administer evidentiary rules under which a gatekeeping obligation depended upon a distinction between “scientific” knowledge and “technical” or “other specialized” knowledge. There is no clear line that divides the one from the others. Disciplines such as engineering rest upon scientific knowledge. Pure scientific theory itself may depend for its development upon observation and properly engineered machinery. And conceptual efforts to distinguish the two are unlikely to produce clear legal lines capable of application in particular cases. Cf. Brief for National Academy of Engineering as *Amicus Curiae* 9 (scientist seeks to understand nature while the engineer seeks nature’s modification); Brief for Rubber Manufacturers Association as *Amicus Curiae* 14–16 (engineering, as an “applied science,” relies on “scientific reasoning and methodology”); Brief for John Allen et al. as *Amici Curiae* 6 (engineering relies upon “scientific knowledge and methods”).

Neither is there a convincing need to make such distinctions. Experts of all kinds tie observations to conclusions through the use of what Judge Learned Hand called “general truths derived from ... specialized experience.” Hand, *Historical and Practical Considerations Regarding Expert Testimony*, 15 Harv. L. Rev. 40, 54 (1901). And whether the specific expert testimony focuses upon specialized observations, the specialized translation of those observations into theory, a specialized theory itself, or the application of such

a theory in a particular case, the expert’s testimony often will rest “upon an experience confessedly foreign in kind to [the jury’s] own.” *Ibid.* The trial judge’s effort to assure that the specialized testimony is reliable and relevant can help the jury evaluate that foreign experience, whether the testimony reflects scientific, technical, or other specialized knowledge.

We conclude that *Daubert*’s general principles apply to the expert matters described in Rule 702. The Rule, in respect to all such matters, “establishes a standard of evidentiary reliability.” 509 U.S., at 590. It “requires a valid ... connection to the pertinent inquiry as a precondition to admissibility.” *Id.*, at 592. And where such testimony’s factual basis, data, principles, methods, or their application are called sufficiently into question, see Part III, *infra*, the trial judge must determine whether the testimony has “a reliable basis in the knowledge and experience of [the relevant] discipline.” 509 U.S., at 592.

B

The petitioners asked more specifically whether a trial judge determining the “admissibility of an engineering expert’s testimony” may consider several more specific factors that *Daubert* said might “bear on” a judge’s gate-keeping determination. These factors include:

- Whether a “theory or technique ... can be (and has been) tested”;
- Whether it “has been subjected to peer review and publication”;
- Whether, in respect to a particular technique, there is a high “known or potential rate of error” and whether there are “standards controlling the technique’s operation”; and
- Whether the theory or technique enjoys “general acceptance” within a “relevant scientific community.” 509 U.S., at 592–594.

Emphasizing the word “may” in the question, we answer that question yes.

Engineering testimony rests upon scientific foundations, the reliability of which will be at issue in some cases. See, e.g., Brief for Stephen Bobo et al. as *Amici Curiae* 23 (stressing the scientific bases of engineering disciplines). In other cases, the relevant reliability concerns may focus upon personal knowledge or experience. As the Solicitor General points out, there are many different kinds of experts, and many different kinds of expertise. See Brief for United States as *Amicus Curiae* 18—19, and n. 5 (citing cases involving experts in drug terms, handwriting analysis, criminal *modus operandi*, land valuation, agricultural practices, railroad procedures, attorney’s fee valuation, and others). Our emphasis on the word “may” thus reflects *Daubert*’s description of the Rule 702 inquiry as “a flexible one.” 509 U.S., at 594. *Daubert* makes clear that the factors it mentions do not constitute a “definitive checklist or test.” *Id.*, at 593. And *Daubert* adds that the gatekeeping inquiry must be “‘tied to the facts’” of a particular “case.” *Id.*, at 591 (quoting *United States v. Downing*, 753 F.2d 1224, 1242 (CA3 1985)). We agree with the Solicitor General that “[t]he factors identified in *Daubert* may or may not be pertinent in assessing reliability, depending on the nature of the issue, the expert’s particular expertise, and the subject of his testimony.” Brief for United States as *Amicus Curiae* 19. The conclusion, in our view, is that we can neither rule out, nor rule in, for all cases and for all time the applicability of the factors mentioned in *Daubert*, nor can we now do so for subsets of cases categorized by category of expert or by kind of evidence. Too much depends upon the particular circumstances of the particular case at issue.

Daubert itself is not to the contrary. It made clear that its list of factors was meant to be helpful, not definitive. Indeed, those factors do not all necessarily apply even in every instance in which the reliability of scientific testimony is challenged. It

might not be surprising in a particular case, for example, that a claim made by a scientific witness has never been the subject of peer review, for the particular application at issue may never previously have interested any scientist. Nor, on the other hand, does the presence of *Daubert*’s general acceptance factor help show that an expert’s testimony is reliable where the discipline itself lacks reliability, as, for example, do theories grounded in any so-called generally accepted principles of astrology or necromancy.

At the same time, and contrary to the Court of Appeals’ view, some of *Daubert*’s questions can help to evaluate the reliability even of experience-based testimony. In certain cases, it will be appropriate for the trial judge to ask, for example, how often an engineering expert’s experience-based methodology has produced erroneous results, or whether such a method is generally accepted in the relevant engineering community. Likewise, it will at times be useful to ask even of a witness whose expertise is based purely on experience, say, a perfume tester able to distinguish among 140 odors at a sniff, whether his preparation is of a kind that others in the field would recognize as acceptable.

We must therefore disagree with the Eleventh Circuit’s holding that a trial judge may ask questions of the sort *Daubert* mentioned only where an expert “relies on the application of scientific principles,” but not where an expert relies “on skill- or experience-based observation.” 131 F.3d, at 1435. We do not believe that Rule 702 creates a schematism that segregates expertise by type while mapping certain kinds of questions to certain kinds of experts. Life and the legal cases that it generates are too complex to warrant so definitive a match.

To say this is not to deny the importance of *Daubert*’s gatekeeping requirement. The objective of that requirement is to ensure the reliability and relevancy of expert testimony. It is to make

certain that an expert, whether basing testimony upon professional studies or personal experience, employs in the courtroom the same level of intellectual rigor that characterizes the practice of an expert in the relevant field. Nor do we deny that, as stated in *Daubert*, the particular questions that it mentioned will often be appropriate for use in determining the reliability of challenged expert testimony. Rather, we conclude that the trial judge must have considerable leeway in deciding in a particular case how to go about determining whether particular expert testimony is reliable. That is to say, a trial court should consider the specific factors identified in *Daubert* where they are reasonable measures of the reliability of expert testimony.

C

The trial court must have the same kind of latitude in deciding *how* to test an expert's reliability, and to decide whether or when special briefing or other proceedings are needed to investigate reliability, as it enjoys when it decides *whether* that expert's relevant testimony is reliable. Our opinion in *Joiner* makes clear that a court of appeals is to apply an abuse-of-discretion standard when it "review[s] a trial court's decision to admit or exclude expert testimony." 522 U.S., at 138—139. That standard applies as much to the trial court's decisions about how to determine reliability as to its ultimate conclusion. Otherwise, the trial judge would lack the discretionary authority needed both to avoid unnecessary "reliability" proceedings in ordinary cases where the reliability of an expert's methods is properly taken for granted, and to require appropriate proceedings in the less usual or more complex cases where cause for questioning the expert's reliability arises. Indeed, the Rules seek to avoid "unjustifiable expense and delay" as part of their search for "truth" and the "jus[t] determin[ation]" of proceedings. Fed. Rule Evid. 102. Thus, whether *Daubert*'s specific factors are, or are not, reasonable measures of reliability in a particular case is a matter that the law grants the trial judge broad latitude to

determine. See *Joiner*, *supra*, at 143. And the Eleventh Circuit erred insofar as it held to the contrary.

III

We further explain the way in which a trial judge "may" consider *Daubert*'s factors by applying these considerations to the case at hand, a matter that has been briefed exhaustively by the parties and their 19 *amici*. The District Court did not doubt Carlson's qualifications, which included a masters degree in mechanical engineering, 10 years' work at Michelin America, Inc., and testimony as a tire failure consultant in other tort cases. Rather, it excluded the testimony because, despite those qualifications, it initially doubted, and then found unreliable, "the methodology employed by the expert in analyzing the data obtained in the visual inspection, and the scientific basis, if any, for such an analysis." Civ. Action No. 93—0860—CB—S (SD Ala., June 5, 1996), App. to Pet. for Cert. 6c. After examining the transcript in "some detail," 923 F. Supp., at 1518—519, n. 4, and after considering respondents' defense of Carlson's methodology, the District Court determined that Carlson's testimony was not reliable. It fell outside the range where experts might reasonably differ, and where the jury must decide among the conflicting views of different experts, even though the evidence is "shaky." *Daubert*, 509 U.S., at 596. In our view, the doubts that triggered the District Court's initial inquiry here were reasonable, as was the court's ultimate conclusion.

For one thing, and contrary to respondents' suggestion, the specific issue before the court was not the reasonableness *in general* of a tire expert's use of a visual and tactile inspection to determine whether overdeflection had caused the tire's tread to separate from its steel-belted carcass. Rather, it was the reasonableness of using such an approach, along with Carlson's particular method of analyzing the data thereby obtained, to draw a

conclusion regarding *the particular matter to which the expert testimony was directly relevant*. That matter concerned the likelihood that a defect in the tire at issue caused its tread to separate from its carcass. The tire in question, the expert conceded, had traveled far enough so that some of the tread had been worn bald; it should have been taken out of service; it had been repaired (inadequately) for punctures; and it bore some of the very marks that the expert said indicated, not a defect, but abuse through overdeflection. See *supra*, at 3—5; App. 293—294. The relevant issue was whether the expert could reliably determine the cause of *this* tire's separation.

Nor was the basis for Carlson's conclusion simply the general theory that, in the absence of evidence of abuse, a defect will normally have caused a tire's separation. Rather, the expert employed a more specific theory to establish the existence (or absence) of such abuse. Carlson testified precisely that in the absence of *at least two* of four signs of abuse (proportionately greater tread wear on the shoulder; signs of grooves caused by the beads; discolored sidewalls; marks on the rim flange) he concludes that a defect caused the separation. And his analysis depended upon acceptance of a further implicit proposition, namely, that his visual and tactile inspection could determine that the tire before him had not been abused despite some evidence of the presence of the very signs for which he looked (and two punctures).

For another thing, the transcripts of Carlson's depositions support both the trial court's initial uncertainty and its final conclusion. Those transcripts cast considerable doubt upon the reliability of both the explicit theory (about the need for two signs of abuse) and the implicit proposition (about the significance of visual inspection in this case). Among other things, the expert could not say whether the tire had traveled more than 10, or 20, or 30, or 40, or 50 thousand miles, adding that 6,000 miles was "about how far" he could

"say with any certainty." *Id.*, at 265. The court could reasonably have wondered about the reliability of a method of visual and tactile inspection sufficiently precise to ascertain with some certainty the abuse-related significance of minute shoulder/center relative tread wear differences, but insufficiently precise to tell "with any certainty" from the tread wear whether a tire had traveled less than 10,000 or more than 50,000 miles. And these concerns might have been augmented by Carlson's repeated reliance on the "subjective[ness]" of his mode of analysis in response to questions seeking specific information regarding how he could differentiate between a tire that actually had been overdeflected and a tire that merely looked as though it had been. *Id.*, at 222, 224—225, 285—286. They would have been further augmented by the fact that Carlson said he had inspected the tire itself for the first time the morning of his first deposition, and then only for a few hours. (His initial conclusions were based on photographs.) *Id.*, at 180.

Moreover, prior to his first deposition, Carlson had issued a signed report in which he concluded that the tire had "not been ... overloaded or underinflated," not because of the absence of "two of four" signs of abuse, but simply because "the rim flange impressions ... were normal." *Id.*, at 335—336. That report also said that the "tread depth remaining was 3/32 inch," *Id.*, at 336, though the opposing expert's (apparently undisputed) measurements indicate that the tread depth taken at various positions around the tire actually ranged from 5/32 of an inch to 4/32 of an inch, with the tire apparently showing greater wear along *both* shoulders than along the center, *Id.*, at 432—433.

Further, in respect to one sign of abuse, bead grooving, the expert seemed to deny the sufficiency of his own simple visual-inspection methodology. He testified that most tires have some bead groove pattern, that where there is reason

to suspect an abnormal bead groove he would ideally “look at a lot of [similar] tires” to know the grooving’s significance, and that he had not looked at many tires similar to the one at issue. *Id.*, at 212—213, 214, 217.

Finally, the court, after looking for a defense of Carlson’s methodology as applied in these circumstances, found no convincing defense. Rather, it found (1) that “none” of the *Daubert* factors, including that of “general acceptance” in the relevant expert community, indicated that Carlson’s testimony was reliable, 923 F. Supp., at 1521; (2) that its own analysis “revealed no countervailing factors operating in favor of admissibility which could outweigh those identified in *Daubert*,” App. to Pet. for Cert. 4c; and (3) that the “parties identified no such factors in their briefs,” *ibid.* For these three reasons *taken together*, it concluded that Carlson’s testimony was unreliable.

Respondents now argue to us, as they did to the District Court, that a method of tire failure analysis that employs a visual/tactile inspection is a reliable method, and they point both to its use by other experts and to Carlson’s long experience working for Michelin as sufficient indication that that is so. But no one denies that an expert might draw a conclusion from a set of observations based on extensive and specialized experience. Nor does anyone deny that, as a general matter, tire abuse may often be identified by qualified experts through visual or tactile inspection of the tire. See Affidavit of H. R. Baumgardner 1—2, cited in Brief for National Academy of Forensic Engineers as *Amici Curiae* 16 (Tire engineers rely on visual examination and process of elimination to analyze experimental test tires). As we said before, *supra*, at 14, the question before the trial court was specific, not general. The trial court had to decide whether this particular expert had sufficient specialized knowledge to assist the jurors “in deciding the particular issues in the case.” 4 J. McLaughlin, Weinstein’s Federal Evidence ¶702.05[1], p. 702—33 (2d ed. 1998); see also

Advisory Committee’s Note on Proposed Fed. Rule Evid. 702, Preliminary Draft of Proposed Amendments to the Federal Rules of Civil Procedure and Evidence: Request for Comment 126 (1998) (stressing that district courts must “scrutinize” whether the “principles and methods” employed by an expert “have been properly applied to the facts of the case”).

The particular issue in this case concerned the use of Carlson’s two-factor test and his related use of visual/tactile inspection to draw conclusions on the basis of what seemed small observational differences. We have found no indication in the record that other experts in the industry use Carlson’s two-factor test or that tire experts such as Carlson normally make the very fine distinctions about, say, the symmetry of comparatively greater shoulder tread wear that were necessary, on Carlson’s own theory, to support his conclusions. Nor, despite the prevalence of tire testing, does anyone refer to any articles or papers that validate Carlson’s approach. Compare Bobo, *Tire Flaws and Separations, in Mechanics of Pneumatic Tires* 636—637 (S. Clark ed. 1981); C. Schnuth et al., *Compression Grooving and Rim Flange Abrasion as Indicators of Over-Deflected Operating Conditions in Tires*, presented to Rubber Division of the American Chemical Society, Oct. 21—24, 1997; J. Walter & R. Kiminecz, *Bead Contact Pressure Measurements at the Tire-Rim Interface*, presented to Society of Automotive Engineers, Feb. 24—28, 1975. Indeed, no one has argued that Carlson himself, were he still working for Michelin, would have concluded in a report to his employer that a similar tire was similarly defective on grounds identical to those upon which he rested his conclusion here. Of course, Carlson himself claimed that his method was accurate, but, as we pointed out in *Joiner*, “nothing in either *Daubert* or the Federal Rules of Evidence requires a district court to admit opinion evidence that is connected to existing data only by the *ipse dixit* of the expert.” 522 U.S., at 146.

Respondents additionally argue that the District Court too rigidly applied *Daubert*'s criteria. They read its opinion to hold that a failure to satisfy any one of those criteria automatically renders expert testimony inadmissible. The District Court's initial opinion might have been vulnerable to a form of this argument. There, the court, after rejecting respondents' claim that Carlson's testimony was "exempted from *Daubert*-style scrutiny" because it was "technical analysis" rather than "scientific evidence," simply added that "none of the four admissibility criteria outlined by the *Daubert* court are satisfied." 923 F. Supp., at 1522. Subsequently, however, the court granted respondents' motion for reconsideration. It then explicitly recognized that the relevant reliability inquiry "should be 'flexible,' " that its " 'overarching subject [should be] ... validity' and reliability," and that "*Daubert* was intended neither to be exhaustive nor to apply in every case." App. to Pet. for Cert. 4c (quoting *Daubert*, 509 U.S., at 594—595). And the court ultimately based its decision upon Carlson's failure to satisfy either *Daubert*'s factors or any other set of reasonable reliability criteria. In light of the record as developed by the parties, that conclusion was within the District Court's lawful discretion.

In sum, Rule 702 grants the district judge the discretionary authority, reviewable for its abuse, to determine reliability in light of the particular facts and circumstances of the particular case. The District Court did not abuse its discretionary authority in this case. Hence, the judgment of the Court of Appeals is *Reversed*.

Scalia, J., concurring

SUPREME COURT OF THE UNITED STATES

No. 97—1709

**KUMHO TIRE COMPANY, LTD.,
et al., PETITIONERS
v. PATRICK CARMICHAEL, etc.,
et al.**

**ON WRIT OF CERTIORARI TO THE
UNITED STATES COURT OF APPEALS
FOR THE ELEVENTH CIRCUIT**

[March 23, 1999]

Justice Scalia, with whom Justice O'Connor and Justice Thomas join, concurring.

I join the opinion of the Court, which makes clear that the discretion it endorses—trial-court discretion in choosing the manner of testing expert reliability—is not discretion to abandon the gatekeeping function. I think it worth adding that it is not discretion to perform the function inadequately. Rather, it is discretion to choose among *reasonable* means of excluding expertise that is *fausse* and science that is junky. Though, as the Court makes clear today, the *Daubert* factors are not holy writ, in a particular case the failure to apply one or another of them may be unreasonable, and hence an abuse of discretion.

Stevens, J., dissenting

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[March 23, 1999]

Justice Stevens, concurring in part and dissenting in part.

The only question that we granted certiorari to decide is whether a trial judge “[m]ay . . . consider the four factors set out by this Court in *Daubert v. Merrill Dow Pharmaceuticals, Inc.*, 509 U. S. 579 (1993), in a Rule 702 analysis of admissibility of an engineering expert’s testimony.” Pet. for Cert. i. That question is fully and correctly answered in Parts I and II of the Court’s opinion, which I join.

Part III answers the quite different question whether the trial judge abused his discretion when he excluded the testimony of Dennis Carlson. Because a proper answer to that question requires a study of the record that can be performed more efficiently by the Court of Appeals than by the nine Members of this Court, I would remand the case to the Eleventh Circuit to perform that task. There are, of course, exceptions to most rules, but I firmly believe that it is neither fair to litigants nor good practice for this Court to reach out to decide questions not raised by the certiorari peti-

tion. See *General Electric Co. v. Joiner*, 522 U. S. 136, 150-151 (1997) (Stevens, J., concurring in part and dissenting in part).

Accordingly, while I do not feel qualified to disagree with the well-reasoned factual analysis in Part III of the Court’s opinion, I do not join that Part, and I respectfully dissent from the Court’s disposition of the case.

UNRAVELING LEGAL CITATIONS

by
J. Wright Leonard, CDE, BCFE

Confused when tracking legal citations? Can you distinguish among "Fed.," "F.2d.," "Fed Cas.," and "F.Supp."? How about "*Supra*," "*Ibid.*," "*Id.*," "*Op. cit. supra*," and "*But Cf.*"? Without legal training or some amount of legal background, locating and/or deciphering an opinion, brief, or legal memorandum can be an arduous task, as well as frustrating, testing the endurance of an otherwise patient and unflappable document examiner.

The basic purpose of a legal citation is to allow the reader to locate a cited source accurately and efficiently. It should provide a minimum amount of information necessary to lead one directly to the specific items listed. What follows will give you general insight into finding and following case material in official and unofficial reports, completing research, and writing.

Judicial Material

A judicial citation has several components:

Example: *Daubert v. Merrell Dow Pharmaceuticals, Inc.*, 509 U.S. 579 (1993)

The first number (509) is the volume of the Report

U.S. is the name of the Report (Book).

The second number (579) is the page number on which the case is found.

The year in parenthesis (1993) reflects the year of decision.

Reports are books/publications which print only cases (or cases and annotations). Publications containing other textual material, such as articles or news notes, are cited not as reports, but as periodicals. Every citation must indicate what court decided the case. If the court is not appar-

ent from the name of the report, it is named in the parenthetical that gives the date. (For example, *Leary v. Friedenthal*, 299 S.W.2d 563 (Mo. Ct. App. 1957.) In this example, it is not obvious from the name of the report that the Missouri Appellate Court decided the case, so it is named in parentheses with the year of the decision. At the end of this article there appears a list which includes the more commonly used official and unofficial reports, which may be helpful to you.

Introductory Signals in Citations

In all types of legal writing, it is customary to cite an authority or authorities to show support for a legal or factual proposition or argument. An author may cite:

1. An authority that identifies the source of a quotation.
2. An authority referred to in the text.
3. An authority that directly states or clearly supports his/her legal or factual proposition.
4. An authority that less directly supports the author's proposition, but from which one can infer the proposition.
5. An authority that contradicts the author's proposition.
6. An authority that provides background material that might be useful to the reader in considering the proposition.

Each of these categories of authority is introduced by a different signal — an italicized or underlined word or words, some of which follow below.

Citations in Support of Proposition Advanced

Authorities may be cited in support of statements of either law or fact. The introductory signal to be used depends upon the manner in which the authority supports the statement, not on the type of persuasiveness of the authority.

"*Accord*," (followed by a comma) is used to introduce any authority which directly upholds the

same proposition of law as that advanced in a textual statement, but which is factually distinguishable.

“*Cf.*” is used to introduce any authority which supports a statement, conclusion, or opinion of law different from that in text but sufficiently analogous to lend some support to the text.

“See” (in roman) is used to introduce any authority which constitutes basic source material supporting an opinion or conclusion of either law or fact drawn in a textual statement.

Citations in Opposition to Proposition Advanced

“*Contra,*” (followed by a comma) is used to introduce any authority that directly contradicts a statement of either law or fact or which unequivocally holds the opposite proposition of law.

“*But cf.*” is used to introduce any authority that supports a position on a question of law different from the question of law considered by the text, but sufficiently analogous to it to suggest a result contrary to that endorsed by the textual statement, conclusion, or opinion of law.

“*But see*” (always italicized) is used to introduce any authority that is directly related to the opinion, conclusion, or statement of either law or fact by the text and that casts doubt upon the latter or contravenes one application of it, but does not directly contravene the conclusion as a whole.

Short Citation Forms

Whenever a case or secondary authority has been fully cited previously within the same material, the appropriate one of the following forms may be used, unless (a) two works (whether books or articles) by the same author have been cited previously, or two cases between parties of the same names have been cited previously, or (b) the short-

ened citation would be confusing to a reader for another reason, or (c) the shortened citation would not effect an appreciable saving of space, or (d) either “*Ibid.*” or “*Id.*” is appropriate:

“*Supra.*” A case which has been previously cited fully in the same footnote is cited as “*supra.*” (Merten v. Ferson, *supra.*) “*Supra*” is used similarly in citing an article which has been cited previously within the same work, indicating the footnote in which the article has most recently been fully cited. (Pound, *supra* at 860.)

“*Op. cit. supra*” is used similarly in citing a book or pamphlet or such, which has been cited previously within the same work and not too far removed for easy cross-reference. The volume number and page in the authority and the note in which last fully cited (unless the same footnote) must always be given. (2 Sutherland, *op. cit. supra* note 4, at 202.)

Successive Citations

“*Ibid.*” is used to cite substantially the same material on the same page of the same authority (of whatever type) as that referred to in the immediately preceding citation. This form is never used unless an exact repetition of the citation immediately before would be correct in all respects.

“*Id.*” may be used whenever a citation is to the same case or secondary authority as that in the immediately preceding citation. The volume, page, section, or paragraph number must be given and any other particular (such as date) in which the subsequent citation varies from the former must be indicated. (*Id.* at 10.) (The number 10 in this case is the page number.)

General Rules of Style

Quotations

Quotations of five or more printed lines uninter-

rupted by the quoter's text are ordinarily indented and set in smaller type with quotation marks; shorter quotations are ordinarily incorporated into the text and set off by quotation marks. Always place commas and periods inside quotation marks. Place all other punctuation outside quotation marks unless it is part of the material quoted.

Certain alterations of material quoted are indicated by parenthetical sentences following the citation. For example: "He was not guilty." 346 U.S. at 9. (Emphasis added.)

Apparent mistakes in the original of the quoted material that are so significant that the reader would be troubled are marked "[sic.]" For example: "It must be so; otherways [sic] the results would be inconsistent."

Punctuation

Units in a series are separated by commas, except that a comma is never used preceding an ampersand. A comma is never used in a number which is part of a citation. (Example: *United States v. 49334 Jars of Molasses*). The use of commas in citations to cases and secondaries is not governed by the use in the report or source. Full dates are separated and ended by commas, but no comma is used when only the month and year are given. For example: The act passed on December 31, 1968 was signed. The October 1968 Term ended.

Omissions

Any omission in quoted material is indicated by three periods separated by spaces between them and between the first and last period and surrounding text. A fourth period is used to indicate the end of a sentence. ("The appeal failed . . . The court gave two reasons . . . So the defendant . . . was then ordered hanged.")

Type Face Words in Text

The following rules are applicable to both text and textual matter in footnotes.

Roman

Except for the italicized words of foreign derivation, words in ordinary text should never be italicized unless absolutely essential to convey the meaning of the author. In addition to ordinary text, the following should be in regular roman:

- (a) Names of statutory and quasi-statutory materials;
- (b) Names of briefs and records;
- (c) Names of authors of books, articles, or other materials;
- (d) Article, chapter, and division titles, in quotation marks
(Example: In the chapter "Husband and Wife" he agreed.).

Italics

The following should be printed in italics:

- (a) Names of cases, including "v." and Latin words used in the case name, but not including "case" and "the" unless those words are part of the name in the official report or part of a recognized popular name (Examples: In *Langdell v. Austin* the judge mentioned *In re MacLacklan. The Japanese Immigrant Case. But: The Langdell case.*); cases named in text are always italicized even if the full citation is also given in text, whereas in footnotes they are italicized only if not fully cited;
- (b) Names of all publications of whatever character, including reports, periodicals, press releases and other informal matter, codifications, and ordinary books and treatises (Examples: He then quoted Blackstone's *Commentaries* but noted that the opposite is said in the *Restatement of Contracts*. Sandra Leverant observed, in an article in the *Yale Law Journal* entitled "The Case for Wire Tapping . . .");

- (c) Capital letters used to represent proper names of hypothetical parties or places (Example: A went to his bank, B, in State X and removed C's deposit.);
- (d) The letters "I" and "O" when used as subdivisions (Examples: § 22(o); § 23(l));
- (e) Commas, apostrophes, colons, semicolons, and quotation marks only as part of an italicized word or phrase.

Citations in Footnotes

The following rules are applicable to footnotes containing only authority and to full citations within textual footnotes:

The following are printed in regular roman in footnotes:

- (a) Names of cases fully cited, including "v.";
- (b) Names of statutory and quasi-statutory materials, and words indicating prior and subsequent history of such materials;
- (c) Names of briefs and records;
- (d) Names of reports when used in citations (as abbreviated), the category reports including all sources that present only primary (judicial, statutory, and quasi-statutory) materials and annotations thereto, and present such materials in approximate chronological order;
- (e) Author and title of materials of an informal nature, such as press releases;
- (f) Names of periodicals which are not consecutively paginated by volume;
- (g) Letters, speeches, interviews, and similar matter;
- (h) Names of authors when the author's name is not necessary to identify the source cited, such as the author of a law review article or a numbered congressional document;
- (i) Designations of student work, such as "Note" and "Comment";
- (j) The introductory signals "See," "See also," "Compare," and "See generally."

The following are printed in *italics* in footnotes:

- (a) Latin words in the case name *-ex parte, ex*

rel., in re;

(b) Latin words in shortened citation forms *-ibid., id., infra., op. cit. supra, and supra;*

(c) Title of material cited when not necessary to identify the source, such as the title of a law-review article or a numbered congressional document and also the full title of congressional hearings;

(d) All introductory signals except "See," "See also," "Compare," and "See generally."

Below are listed the commonly used official and unofficial reports for your reference:

Abbott's Appeals Decisions [N.Y. 1850-1869]	Abb. App. Dec.
Abbott's New Cases [N.Y. 1874-1894]	Abb. N. Cas.
Abbott's Practice Reports [N.Y. 1854-1865]	Abb. Pr.
Abbott's Practice Reports, New Series [N.Y. 1863-1876]	Abb. Pr. (n.s.)
Agriculture Decisions [1942-date]	Agri. Dec.
Alabama Appellate Court Reports [1910-date]	Ala. App.
Allen [Mass. 1861-1867]	Allen
American and English Annotated Cases [1902-1918]	Am. & Eng. Ann. Cas.
American Annotated Cases [1904-1912]	Am. Ann. Cas.
American Bankruptcy Reports [1889-1923]	Am. Bankr. R.
American Bankruptcy Reports, New Series [1923-1945]	Am. Bankr. R. (ns.)
American Decisions [1765-1870]	Am. Dec.
American Federal Tax Reports (P-H) [1880-1957]	Am. Fed. Tax R.
American Federal Tax Reports, Second Series (P-H) [1957-date]	Am. Fed. Tax R. 2d
American Labor Arbitration Awards (P-H) Awards [1945-date]	Am. Lab. Arb. Awards
American Labor Cases (P-H) [1947-date]	P-H Am. Lab. Cas.
American Law Reports Annotated [1913-1948]	A.L.R.
American Law Reports Annotated, Second Series [1944-date]	A.L.R. 2d
American Maritime Cases [1922-date]	Am. Mar. Cas.
American Reports [1868-1887]	Am. Rep.
American State Reports [1887-1911]	Am. St. Rep.
Appeals Cases, District of Columbia [1893-date]	App. D.C.
Appellate Division Reports, N.Y. Supreme Court [1896-1955]	App. Div.
Appellate Division Reports, N.Y. Supreme Court, Second Series [1955-date]	App. Div. 2d
Atlantic Reporter [1885-1938]	Atl.
Atlantic Reporter, Second Series [1938-date]	A.2d
Automobile Cases (CCH) [1938-1952]	Auto. Cas.
Automobile Cases, Second Series (CCH) [1952-date]	Auto. Cas. 2d
Aviation Cases (CCH) [1822-date]	Av. Cas.
B. Monroe [Ky. 1840-1858]	B. Mon.
Barbour's Supreme Court Reports [N.Y. 1847-1876]	Barb.
Binney [Pa. 1799-1814]	Binn.

Black [U.S. 1861-1862]	Black	Heiskell [Tenn. 1870-1875]	Heisk.
Board of Tax Appeals Reports [1924-1942]	B.T.A.	Hempstead's Circuit Court Reports [Ark. Terr. 1820-1856]	Hemp.
Boyce [Del. 1909-1920]	Boyce	Hening and Munford [Va. 1806-1809]	Hen. & M.
Bush [Ky. 1866-1879]	Bush	Hill [N.Y. 1841-1844]	Hill
Caines' Cases [N.Y. 1795-1805]	Cai. Cas.	Houston [Del. 1855-1894]	Houst.
Caines' Reports [N.Y. 1803-1805]	Cai. R.	Howard [U.S. 1843-1860]	How.
California Appellate Reports [1905-1934]	Cal. App.	Howard's Practice [N.Y. 1844-1884]	How. Pr.
California Appellate Reports, Second Series [1934-date]	Cal. App. 2d	Howard's Practice, New Series [N.Y. 1884-1886]	How. Pr. (ns.)
California Appellate Decisions [1905-1940]	Cal. App. Dec.	Humphrey [Tenn. 1839-1851]	Humph.
California Appellate Decisions Supplement [1929-1940]	Cal. App. Dec. Supp.	Hun [N.Y. 1874-1896]	Hun
Call [Va. 1793-1825]	Call	Illinois Appellate Court Reports [1877-1954]	Ill. App.
Circuit Court of Illinois [1872-1909]	111. Cir. Ct.	Illinois Appellate Court Reports, Second Series [1954-date]	Ill. App. 2d
Civil Aeronautics Authority Reports [1939-1940]	C.A.A.	Illinois Circuit Court [1872-1909]	Ill. Cir. Ct.
Civil Aeronautics Board Reports [1940-1953]	C.A.B.	Illinois Court of Claims Reports [1899-date]	Ill. Ct. Cl.
Coldwell [Tenn. 1860-1870]	Cold.	Immigration and Nationality Decisions [1940-date]	I. & N. Dec.
Coleman's Cases [N.Y. 1791-1800]	Cole. Cas.	Indian Territory Reports [1896-1907]	Indian Terr.
Coleman & Caines' Cases [N.Y. 1794-1805]	Cole. & Cai. Cas.	Indiana Appellate Court Reports [1890-date]	Ind. App.
Colorado Court of Appeals Reports [1891-1915]	Colo. App.	Interior Department Decisions [1881-date]	Interior Dec.
Commissioner of Patents, Decisions [1869-date]	Dec. Corn. Pat.	Interstate Commerce Commission Reports [1887-date]	I.C.C.
Comstock [N.Y. 1847-1851]	Comst.	Johnson's Cases [N.Y. 1799-1804]	Johns. Cas.
Connecticut Supplement [1935-date]	Conn. Supp.	Johnson's Chancery Reports [N.Y. 1814-1823]	Johns. Ch. R.
Court of Claims (U.S.) [1856-date]	Ct. Cl.	Johnson's Reports [N.Y. 1806-1823]	Johns. R.
Court of Customs and Patent Appeals Reports [1929-date]	[e.g.] C.C.P.A. (Patents)	Kentucky Law Reporter [1886-1908]	Ky. L. Rep.
Court of Customs Appeals Reports [1916-1929]	Ct. Cust. App.	Kernan [N.Y. 1854-1857]	Kern.
Court of Military Appeals (U.S.) [1951-date]	U.S.C.M.A.	Labor Arbitration Reports (BNA) [1946-date]	Lab. Arb.
Court-Martial Reports [1951-date]	C.M.R.	Labor Cases (CCH) [1937-date]	CCH Lab. Cas.
Cowen [N.Y. 1823-1829]	Cow.	Labor Relations Reference Manual (BNA) [1935-date]	L.R.R.M.
Cranch [U.S. 1801-1814] [D.C. 1801-1841]	Cranch	Lansing's Supreme Court [N.Y. 1869-1872]	Lans.
Cushing [Mass. 1848-1853]	Cush.	Lawyers' Edition, United States Supreme Court Reports [1754-1956]	L. Ed.
Customs Court Reports [1938-date]	Cust. Ct.	Lawyers' Edition, United States Supreme Court Reports, Second Series [1956-date]	L. Ed. 2d
Dakota Reports (Territorial) [1867-1889]	Dak.	Lawyers Reports Annotated (1888-1906)	L.R.A.
Daly [N.Y. 1859-1891]	Daly	Lawyers Reports Annotated, New Series [1906-1915]	L.R.A. (n.s.)
Dallas [U.S. 1759-1806]	Dall.	Leigh [Va. 1829-1841] Leigh	
Demerest's Surrogate Courts Reports [N.Y. 1882-1888]	Dem.	Life (Health & Accident) Cases (CCH) [1938-1953]	Life Cas.
Delaware Chancery [1814-1953]	Del. Ch.	Life (Health & Accident) Cases, Second Series (CCH) [1953-date]	Life Cas. 2d
Denio [N.Y. 1845-1848]	Denio	Louisiana Annual Reports [1846-1900]	La. Ann.
Duvall [Ky. 1863-1866]	Duv.	Louisiana Courts of Appeal Reports [1924-1932]	La. App.
Federal Carriers Cases (CCH) [1936-date]	Fed. Carr. Cas.	MacArthur [D.C. 1873-1879]	MacArth.
Federal Cases [1789-1880]	Fed. Cas.	MacArthur and Mackey (D.C. 1879-1880)	MacArth. & M.
Federal Communications Commission Reports [1934-date]	F.C.C.	McCahon [Kan. Terr., Kan. 1858-1868]	McCah.
Federal Power Commission Reports [1931-date]	F.P.C.	Mackey [D.C. 1880-1892]	Mackey
Federal Reporter [1880-1924]	Fed.	Manning's Unreported Cases [La. 1877-1880]	Mann. Unrep. Cas.
Federal Reporter, Second Series [1924-date]	F.2d	Marvel [Del. 1893-1897]	Marv.
Federal Rules Decisions [1938-date]	F.R.D.	Massachusetts Appellate Decisions [1941-1947]	Mass. App. Dec.
Federal Supplement [1932-date]	F. Supp.	Massachusetts Appellate Division Reports [1936-1950]	Mass. App. Div.
Federal Trade Commission Decisions [1915-date]	F.T.C.	Metcalf [Mass. 1840-1847]	Met.
Fire and Casualty Cases (CCH) [1938-date]	Fire & Casualty Cas.	Metcalf LKy. 1858-1863]	Met.
Florida Supplement [1950-date]	Fla. Supp.	Mills [N.Y. 1841-1867]	Mills
Georgia Appeals Reports [1907-date]	Ga. App.	Missouri Appeal Reports [1876-date]	Mo. App.
Gilmer [Va. 1820-1821]	Gilm.	Monroe, B. LKY. 1840-1858]	B. Mon.
Grattan [Va. 1844-1880]	Gratt.	Monroe, T. B. [Ky. 1824-1828]	T.B. Mon.
Gray [Mass. 1854-1860]	Gray	Motor Carrier Cases (ICC) [1936-date]	M.C.C.
Greene [Iowa 1847-1854]	Greene	Munford [Va. 1810-1820]	Munf.
Harrington [Del. 1832-1855]	Harr.	National Labor Relations Board Decisions [1935-date] N.L.R.B.	
Harrington, W. W. [Del. 1919-1939]	W. W. Harr.	National Railroad Adjustment Board Awards [1934-date]	[e.g.] N.R.A.B. (4th Div.)
Haywood [Tenn. 1814-1818]	Hay.		
Head [Tenn. 1858-1860]	Head		

Negligence & Compensation Cases Annotated [1911-1935] Ann.	Negl. & Comp. Cas.	Peters [U.S. 1828-1842]	Pet.
Negligence & Compensation Cases Annotated, New Series [1936-1952]	Negl. & Comp. Cas. Ann. (n.s.)	Pickering [Mass. 1822-1839]	Pick.
Negligence & Compensation Cases Annotated, Third Series [1952-date]	Negl. & Comp. Cas. Ann. 3d	Pinney [Wis. 1839-1852]	Pin.
Negligence Cases (CCH) [1938-1952]	Negl. Cas.	Porto Rico Federal Reports [1900-1924]	P.R. Fed.
Negligence Cases, Second Series (CCH) [1952-date]		Public Utilities Reports Annotated [1915-1933]	P.U.R.
New Jersey Equity [1830-1948]	Negl. Cas. 2d	Public Utilities Reports, New Series [1933-1953]	P.U.R. (n.s.)
New Jersey Law [1790-1948]	N.J. Eq.	Public Utilities Reports, Third Series [1953-date]	P.U.R. 3d
New Jersey Miscellaneous [193-1949]	N.J.L.	Puerto Rico Reports [1899-date]	P.R.R.
New Jersey Reports [1948-date]	N.J. Misc.	Randolph [Va. 1821-1828]	Rand.
New Jersey Superior Court Reports [1948-date] N.J. Super.	N.J.	Rawle [Pa. 1828-1835]	Rawle
New York Civil Procedure [1881-1907]	N.Y. Civ. Proc	Decisiones de Puerto Rico [1899-date]	D.P.R.
New York Civil Procedure, New Series [1908-1913]	N.Y. Civ. Proc. (n.s.)	Robinson [Va. 1842-1844]	Rob.
New York Criminal Reports [1881-1924]	N.Y. Crim.	Securities and Exchange Commission Decisions and Reports [1934-date]	S.E.C.
New York Department Reports [1912-date]	N.Y. Dep't R.	Selden [N.Y. 1851-1854]	Seld.
New York Miscellaneous [1892-1955]	Misc.	Sergeant and Rawle [Pa. 1814-1828]	S. & R.
New York Miscellaneous, Second Series [1955-date]	Misc. 2d	Smedes and Marshall [Miss. 1843-1850]	S. & M.
New York Supplement [1888-1937]	N.Y. Supp.	Sneed LTenn. [1853-1858]	Sneed
New York Supplement, Second Series [1937-date]	N.Y.S. 2d	South Eastern Reporter [1887-1939]	S.E.
New York Supreme Court, Appellate Division Reports [1896-1955]	App. Div.	South Eastern Reporter, Second Series [1939-date]	S.E. 2d
New York Supreme Court, Appellate Division Reports, Second Series [1956-date]	App. Div. 2d	South Western Reporter [1886-1928]	S.W.
North Eastern Reporter (1885-1936)	N.E.	South Western Reporter, Second Series [1928-date]	S.W. 2d
North Eastern Reporter, Second Series [1934-date]	N.E. 2d	Southern Reporter [1886-1941]	So.
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Official Gazette, U.S. Patent Office [1872-date]	O.G. Pat. Off.	Supreme Court Reporter [U.S. 1882-date]	Sup. Ct.
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Ohio Circuit Court Reports, New Series [1899-1917]	Ohio C.C.R. (n.s.)	Tax Court of the United States Reports [1942-date]	T.C.
Ohio Courts of Appeals Reports [1916-1922]	Ohio Ct. App.	Tennessee Appeals Reports [1925-date]	Tenn. App.
Ohio Decisions [1894-1920]	Ohio Dec.	Tennessee Chancery Reports [1872-1878]	Tenn. Ch.
Ohio Decisions, Reprint [1840-1893]	Ohio Dec. Reprint	Terry [Del. 1939-date]	Terry
Ohio Law Abstract [1922-date]	Ohio L. Abs.	Texas Civil Appeals Reports (1892-1911)	Tex. Civ. App.
Ohio Nisi Prius Reports [1894-1901]	Ohio N.P.	Texas Court of Appeals Reports [1876-1893]	Tex. Ct. App. R.
Ohio Nisi Prius Reports, New Series [1902-1934]	Ohio N.P. (n.s.)	Texas Court of Appeals Decisions, Civil Cases [1877-1892]	Tex. Ct. App. Dec. Civ.
Ohio Opinions [1931-1956]	Ohio Op.	Texas Criminal Reports [1876-date]	Tex. Crim.
Ohio Opinions, Second Series [1955-date]	Ohio Op. 2d	Trade Cases (CCH) [1940-date]	Trade Cas.
Ohio Reports [1821-1852]	Ohio	Tucker and Clephane [D.C. 1892-1893]	Tuck. & Cl.
Ohio State Reports [1852-date]	Ohio St.	United States and Canadian Aviation Reports [1952-date]	U.S. & Can. Av.
Oklahoma Criminal Reports [1908-date]	Okla. Crim.	United States Aviation Reports [1822-1951]	U.S. Av.
Pacific Reporter L [1883-1931]	Pac.	United States Court of Military Appeals [1951-date]	U.S.C.M.A.
Pacific Reporter, Second Series (1931-date)	P. 2d	United States Patent Quarterly [1929-date]	U.S.P.Q.
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Pennsylvania County Court Reports [1870-1921]	Pa. County Ct.	Valuation Reports (ICC) [1929-date]	Val. R. (ICC)
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Pennsylvania District and County Reports, Second Series (1952-date)	Pa. D. & C. 2d	Wage and Hour Cases (BNA) [1939-date]	Wage & Hour Ca
Pennsylvania District Reports [1892-1921]	Pa. Dist.	Wallace [U.S. 1863-1874]	Wall.
Pennsylvania State Reports [1845-date]	Pa.	Washington Territory Reports [1854-1888]	Wash. Terr.
Pennsylvania Superior Court Reports [1895-date]	Pa. Super.	Watts [Pa. 1832-1840]	Watts
Penrose and Watts [Pa. 1829-1832]	Pen. & W.	Watts and Sergeant [Pa. 1841-1845]	W. & S.
		Wendell [N.Y. 1828-1841]	Wend.
		Wharton [Pa. 1835-1841]	Whart.
		Wheaton [U.S. 1816-1827]	Wheat.
		Yeates [Pa. 1791-1808]	Yeates

The rules of citation herein and the list of reports were taken from *A Uniform System of Citation*, (Tenth Ed. 1960) published by The Harvard Law Review Association, Cambridge Massachusetts, in conjunction with the *Columbia Law Review*, the *University of Pennsylvania Law Review*, and the *Yale Law Journal*. For more detailed information on citation rules, please refer to this publication in its entirety. This book may be purchased from the Harvard Law Review Association. The price is \$9.00, including postage and handling. Supplements may be obtained from the Harvard Law Review Association after October 15 of each year for a small charge.

Other sources of information which you might consider include: For spelling, syllabication and italicization, see *Merriam-Webster New International Dictionary*; for punctuation and capitalization, see *U.S. Government Printing Office Style Manual*; for grammar, see *Fowler, Modern English Usage*; and for abbreviation, except for periodicals, see *Black's Law Dictionary*.

J. Wright Leonard, CDE, BCFE, was first court qualified as an expert witness in 1983. She was one of the first members of NADE, joining in 1981, and is presently the Research Editor of the NADE Journal. Ms. Leonard is a member of the IAI (NYS Division), the Association of Certified Fraud Examiners and the Evidence Photographers International Council. Certified by NADE and the ACFE, she operates from her office in Philadelphia; has been retained by clients throughout the Eastern United States; and has lectured on handwriting identification and fraudulent documents before such organizations as the American Dental Association and the Association of Certified Fraud Examiners.

CASE NOTES

EXAMINATION OF A PASSPORT

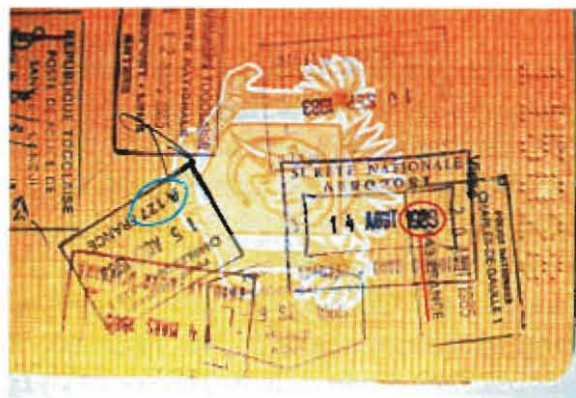
by

Katherine Koppenhaver, A.A.S., CDE,
Diplomate

One of the requirements for American citizenship is a period of continuous residence in the United States. An immigrant was denied citizenship in the United States because the attorney for the Department of Immigration stated that she had left the United States in 1989, which would have violated the requirement. The attorney based his statement on a copy of her passport. (See Figure 1.)

The immigrant had visited Paris in 1983. Her entrance stamp clearly reflects her re-entry to the United States in 1983. However, her exit stamp was placed over the printed letter, A, which made the 3 resemble a 9. An enlarged colored photograph reveals the problem. (See Figure 2.) The top of the A closes the oval on the 3 so that it resembles a 9. The genuine 9 in 1983 has a deeper oval than the one created by the A in the 3.

The document was photographed by William A. Koppenhaver to clearly demonstrate the truth of the documents. Photos were taken with a 35mm camera using a standard 50 mm lens and extension tubes. The film was Kodak Gold ASA 100 and an electronic flash was used for illumination. The pictures were developed at a camera shop, and for a small additional sum, the 24 pictures were scanned and saved to a Photo CD. This service saved the time of scanning the photographs. Some minor color touch up was done with a graphics program, but the pictures were fairly close to true color. When printed on one of the newer color printers on glossy photographic paper they approach the quality of conventional color prints.



In Figure 1 above, notice the questioned date which has been circled in red to help with this illustration. Without careful microscopic examination this appears to be the date 1989. Notice the code "A 127" which has been circled in aqua on the stamp to the left of the questioned stamp. Now look at the stamp which is at a 90 degree angle to the questioned stamp. This stamp has a code on the bottom line (underlined in red). It is the "A" of this code which has caused the problem in the questioned date as is shown in Figure 2.



The date 1983 which is in red and blue (depending on whether the ink from the stamp is on top of the yellow or the white in the background) appears to be 1989 because the top of the "A" of the code "A 143" fills in the 3 to make it look like a 9. As an additional factor, note the difference in shape in the loop of the actual 9 in the date as compared to the top of the 3.

Katherine Koppenhaver, A.A.S., CDE, is a past President of NADE, and a long-standing member with Diplomate status. She is the Editor of the NADE Communique and a frequent contributor and workshop presenter. She holds an associate degree in Criminal Justice and has authored numerous books on handwriting identification and other aspects of document examination. Her business, Forensic Document Examination, is based in Joppa, Maryland, where she partners with her husband, William Koppenhaver, an expert in evidence photography.

CASE NOTES

THE WHOLE PICTURE

by

Eva Salzer, CDE with Rina Salzer

A recent case brought to light the importance of getting as many standards as possible, evaluating all of the writing on the questioned document and not just the signature, thereby requiring that the standards contain all of the writing on the questioned.

When forwarding the questioned document, which was a signed check with an address written below it, the attorney asked that only the signature be compared. The standard included one page of request writing on which the suspect signed her name ten times in a row, and listed the letters of the alphabet.

A comparison of the questioned signature to the standard signatures, revealed enough dissimilarities to render an opinion that they were not penned by the same person.

One year later, the opposing expert's opinion on the case, as well as all of the documents from which he based his opinion, was received. His opinion was that they were penned by the same person, but the standards he had examined were entirely different from those which were submitted to these authors for examination, as far more numerous standards had been submitted. The standards provided to the opposing examiner were writings that contained the signature and the address written several times. In reading through his argument/list of comparisons between the writing on the questioned and the standards, it became evident that he mostly compared the writing of the address, including the numbers in it, which resulted in a strong argument. Each of his comparisons were examined, one-by-one, and it was discovered that the majority of them checked

out. This did bring attention to the importance of comparing the address.

Subsequent to discussing this with the attorney, he finally provided what was needed -- 80 known checks, formatted exactly the same as the questioned check, with signature and address. After an examination of the additional evidence, there no longer was any question that the address written below the signatures on the checks was identical to the address written on the questioned check.

The identification became obvious solely by looking at all the writing versus only the signature. It was also clear at that time that, much to the attorney's dismay, this was an open-shut case, and one in which it became necessary to forfeit the initial stance-and all as a result of not being asked to compare the whole picture in the beginning.

Eva R. Salzer, M.A., B.A., CDE, has taken a leadership role in NADE by serving as Chair of the Ethics and Membership Committees, and has also served on the Certification Committee. She is Past Vice President of the California Coalition of Forensic Handwriting Experts. From her base in Santa Monica, CA., she has been called upon to lecture to various Bar Associations and Public Defender organizations. Adding to her credits, she was assigned U. S. Delegate to China under the Cultural Exchange Program in Handwriting in 1987.

Rina Salzer, B.A., is a NADE Student Member and apprentices with Eva Salzer, CDE, in Santa Monica, CA. She is currently entering Andrew Bradley's Advanced Document Examination Program, having completed the Basic Course. She intends to establish her own business upon attainment of her certification.

Forensically Speaking

by

Phyllis Cook, CDE, Dilpomate¹

- + The American Bar Association took a technology survey last year, and results show that more and more law firms are using the Internet to locate various experts. Presently, over 85% of law firms search the Internet. In fact, use of the Internet more than doubled in one year's time, proving that it behooves an expert to advertise via a web site or to list with a technological service or directory.
- + The difference between an expert witness and a lay witness is that an expert is permitted to testify to opinion, whereas a lay person can only testify to what s/he has seen, without any speculation. For example, an expert can say, "Because of the length of the tire marks, I believe that the car was traveling at 80 mpg." On the other hand, the lay witness can say, "The car was traveling very fast".
- + There are three basic components present in every handwriting: form (comprising every stroke and detail); movement (the physical activity producing the form) and organization (the distribution of the writing on the writing surface).
- + In court, document examiners are occasionally asked to come up with mathematical assessments for their opinions with questions such as "What percentage of people write capital C's like that?", or "To what mathematical certainty does that apply?" Because we testify to opinion, not mathematical certainty, such questions are moot. We can render credible testimony without use of percentages. A court case that agrees that an expert can be competent without mathematical certainty is *Boudreau v. S/V Shere Kahn C* (27 F. Supp. 2d 72)
- + Karl Aschaffenburg has stated that "a wholly mature handwriting is solely at the service of communication."
- + Although most people think the ball-point pen was invented in the 1940's, John J. Loud was awarded patent #392046 in 1888 for a pen with a spherical point that could revolve in all directions.
- + Liquid pens have been around for more than 5,000 years. The ancient Egyptians used slit, hollow reeds, and the ancient Chinese used bamboo reeds. It wasn't until the Middle Ages that quills were introduced.
- + The best method to save wet books is to freeze them in a vacuum freezer, and this should be done as soon as possible after the damage. This special vacuum freezer will remove the moisture without damaging the pages. If there is a delay in locating such a freezer, place the books in a normal freezer until a vacuum freezer can be located. (from The American Red Cross, Phila. PA)
- + The term "pronation" is mentioned in the Secret Service manual in regard to handwriting. It is the act of turning one's hand so that the palm faces in the opposite direction. Many left handed writers pronate, or rotate, the left hand when writing.
- + Every trade or profession has a specialized vocabulary. In the printing trade, a Journal such as this one is called a "book". It is made from 11x17 sheets which are folded to yield four distinctly numbered 8-1/2x11 pages. One 11 x 17 sheet is a "signature".

¹With contributions from J. Wright Leonard, CDE, BCFE and Frank Kissner at Pleasantville Printing and Graphics

JOURNAL OF THE NATIONAL ASSOCIATION OF DOCUMENT EXAMINERS

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2. As part of the above, submit one camera-ready print copy or electronic file of each exhibit or illustration you intend to have in this paper. If you desire to submit illustrations electronically, contact the editor in advance to discuss format. Each illustration should have a figure number by which it is referred to in the paper, and a caption or text which succinctly identifies it and states its purpose.
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2. Name(s) of author, and if multiple, the one(s) who will deal with the Editorial Board should be clearly indicated.
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4. The paper should have clearly demarcated sections. There are no rigid requirements in this regard, only that it should be logically developed and helpful to the reader.

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